AIR ENGINEERING

VOL. 2, NO. 7

JULY, 1960

DEDICATED TO THE SCIENCE OF AIR POLLUTION CONTROL
AIR MOVING • AIR CONDITIONING

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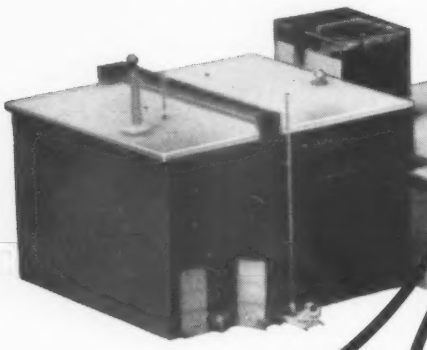
AAF clean-air engineering make

...despi

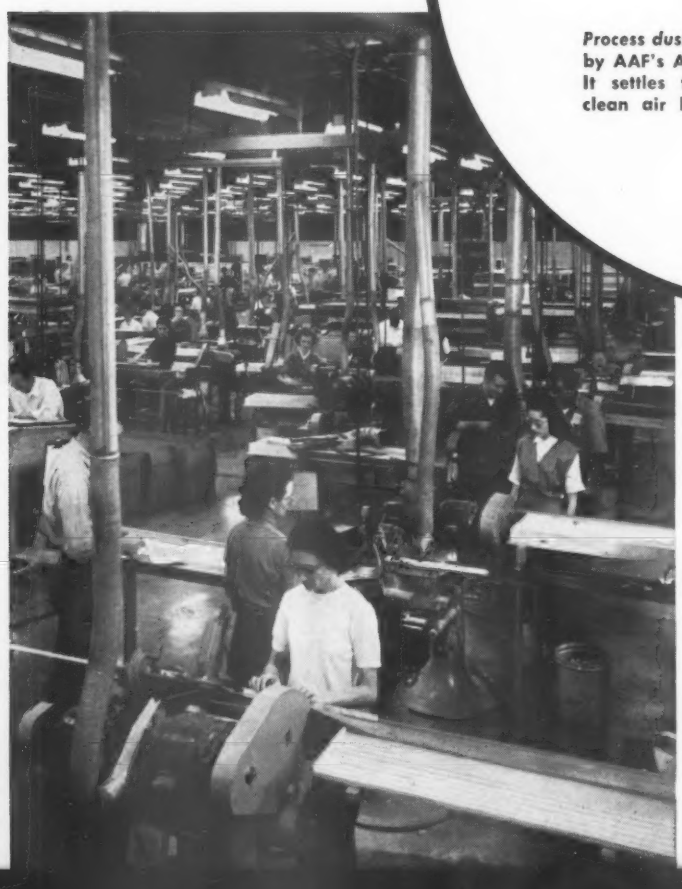
ATMOSPHERIC DUST

Atmospheric dust **is taken out of the intake air by AAF's Roll-O-Matic air filter located in the air conditioning apparatus room. Recirculated ventilation air also is continuously cleaned by the Roll-O-Matic.**



PROCESS DUST

Process dust **from 150 dust sources is collected by AAF's AMERjet reverse jet fabric collector. It settles the dust in its hoppers, returns clean air back through the central system.**



Interior of plant showing multitude of dust-producing operations.

...ir conditioning practical here...

...50 dust-producing operations going full blast!

PRATT, READ & COMPANY MANUFACTURING PLANT, Central, South Carolina; General Contractor: Daniel Construction Company, Greenville, S. C.; Mechanical Contractor: Davis Mechanical Contractors, Inc., Greenville.

AAF system permits air recirculation, slashes heating-cooling, maintenance costs

Pratt, Read & Company, manufacturers of piano keys and actions, wanted its new Central, South Carolina plant to be air conditioned. Reasons: better working environment for its people and improved quality of its products. Problem: the fact that 150 dust-producing operations would be going at full throttle during the working day.

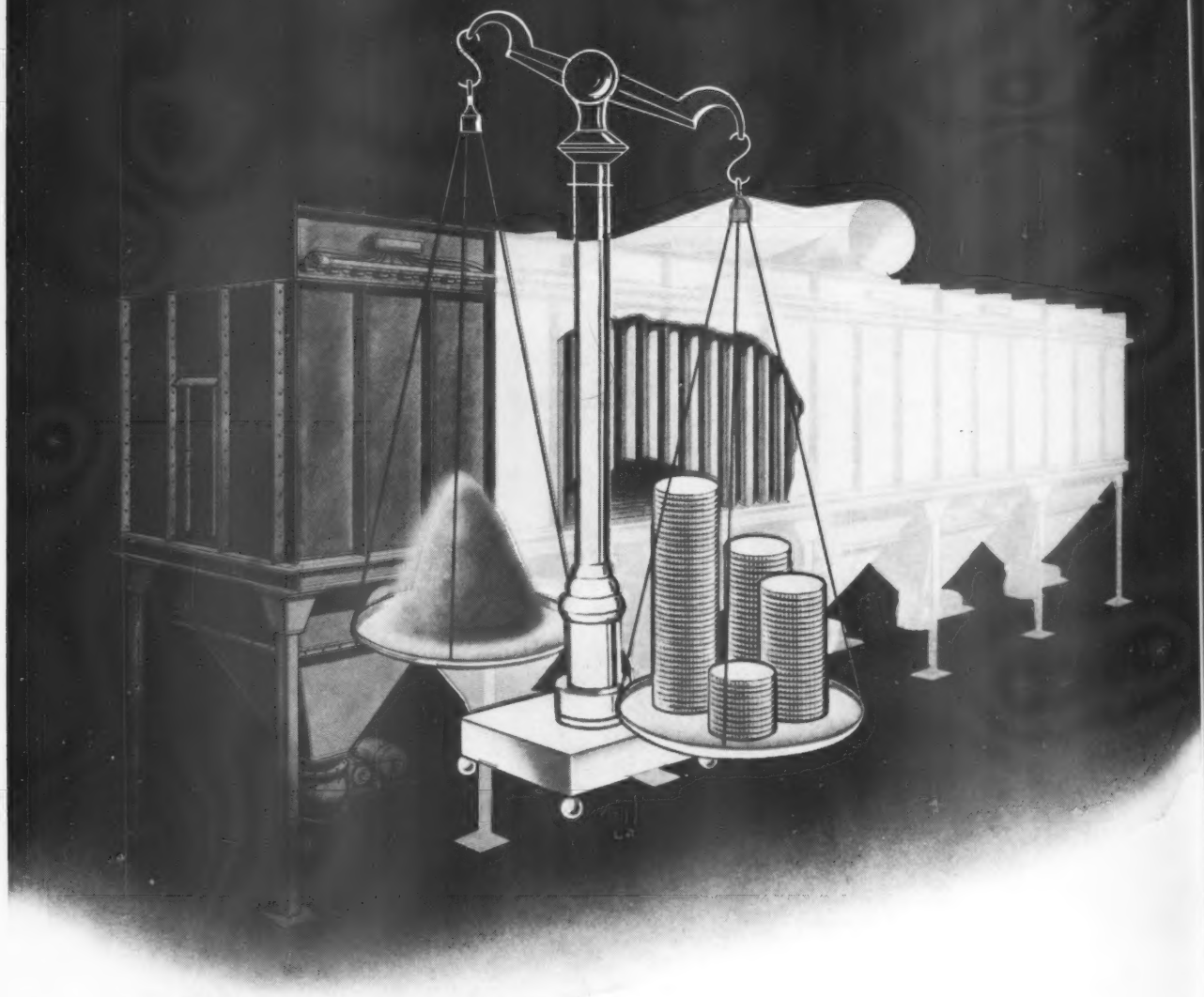
AAF's air engineering knowhow, plus its complete line of air-cleaning products (for both atmospheric and process dust) made air conditioning practical by providing for money-saving recirculation of air. The savings: plenty—lower heating costs in winter, vastly lower cooling costs in summer, and a big savings in plant cleaning costs.

For a look at what we mean by a really *complete* line of equipment, call your local AAF representative or write direct for Bulletin 518. Address: Mr. Robert Moore, American Air Filter Company, Inc., 305 Central Ave., Louisville, Ky.

AAF American Air Filter

BETTER AIR IS OUR BUSINESS

What does your **DUST** *cost per pound?*

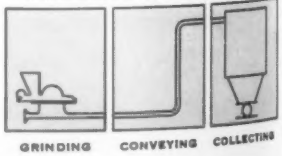


If your present dust control system is not delivering maximum efficiency, you may be paying an exorbitant price for dust. It's a mighty expensive item when you consider the damaging effect on equipment, on employee morale, on general plant appearance and community relations. The most practical and *economical* solution of any nuisance dust problem is the MIKRO-PULSAIRE Collector, now available in new flexible modular units designed to meet any required capacity however large or small . . . attested recovery efficiency 99.9% plus . . . absolutely no moving parts, internally or in the gas stream . . . 4 or 5 times the capacity of conventional bag houses per unit of cloth area. For the toughest nuisance dust collection jobs, call on our engineering staff, and the MIKRO-PULSAIRE.
Ask for Bulletin 52A-1.

MIKRO-Products
PULVERIZING MACHINERY
1 Chatham Rd., Summit, N. J.
A Division of American-Marietta Company

SPAN THE GLOBE

PROCESSING SYSTEMS



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EDITORIAL:

No Place To Hide . . .

ACCORDING TO 1960 census figures, population growth in America's suburbs has jumped nearly 50 percent. During the past decade, some 17-million of us have either fled the big cities for the sparkling air of the suburbs, or chose to be born there.

Soon, however, we won't even be able to escape polluted air without moving so far away from our jobs in industry that it would be a day's work simply commuting.

Mark Hollis, Assistant Chief of the U. S. Public Health Service, has said that by 1980, 75 percent of the projected population growth will live in vast metropolitan complexes, intermingled with the industry that supports them.

Even now, surveys show that a metropolitan area exists all the way from New York City to Washington, D. C.

So long as industry continues to grow it will create new technological processes which in turn will create new air pollutants. And so long as population "explodes" along with the industry that supports this population, we'll have air pollution right along with us, unless we in industry do something about it, and soon.

Otherwise, as William R. Bradley, formerly Chief Industrial Hygienist, American Cyanamid Co., and now an independent consultant, indicated, an aroused but technically ignorant citizenry may pass ill-advised air pollution control regulations. These regulations can result in costly lawsuits . . . or hasty, ill-conceived and too often ineffective control equipment installations. Such legislation may contain impossible or impractical clean air standards, or want too much too soon from an engineering standpoint.

Its time we in industry began to do a better job of policing our air spewings . . . before population congestion forces air pollution control on us.

And it's time industry began to stop making statements like: "Uneconomical . . . the d- - - dust collectors don't make a thing . . . we can't justify air cleaning equipment on any sensible basis. It doesn't make our product faster, better or contribute to lower production costs in any way. It's a direct capital expenditure without any economic return."

If this statement sounds familiar to you, your management needs education on the economic facts of life relating to air pollution control.

Neglect of a serious air pollution problem can be costly. Rightly or wrongly, corporations are losing

(Please turn to following page)

Editorial (Cont.)

No Place To Hide

(Continued from preceding page)

air pollution law suits right now. The Reynolds Metals Company recently paid out $91,500 to a farmer in Troutdale, Oregon for alleged crop and cattle damage from fluoride emissions. This judgment was sustained by the Oregon Supreme Court. And the Ideal Cement Company paid out $10,800 just a few months ago to a nearby family for property damage allegedly caused by dust from their plant, on the basis of a jury decision.

There are more immediate, tangible benefits . . . the dollars and cents kind a board of directors can understand. Heavy emissions can hurt your products, especially if you store them outside prior to shipment. New cars outside auto factories have had paint finish damage, for example.

Some emissions foul up air intakes, or gather on rooftops where a sizeable work force must be employed to clean up to keep dust from blowing right back into the plant. And many a plant has been known to foul its own air through short-circuiting of dirt laden air from stacks, right back into the plant through make-up air blowers. Even dirty windows, once kept clean, can cut lighting bills substantially.

There are cases on record where in seeking ways and means of reducing air pollution, production changes were discovered that ended pollution and resulted in increased production efficiency.

And there are plenty of practical ways to cut pollution and at the same time save heat otherwise wasted to atmosphere. Heating bill savings can go a long way towards amortizing dust collectors.

And if you clean up your own emissions, your industrial neighbor may be persuaded to clean up his and remove a headache for you. We know of a metal grinding and buffing operation . . . nicest looking hoods you ever saw, but the metal dust . . . it went straight to atmosphere . . . straight into the open paint buckets of a sign painting firm next door.

Then there's the less tangible but very real problem of community relations. Your management spends lots of dough on community relations . . . which goes right up the stack with your emissions. It's money wasted. A plant that fouls the air can have poor community relations and the reduced employee morale that goes with these relations. And an employee who is ashamed to admit he works for you surely won't have his heart and soul in his work.

Industry had best police itself and stop thinking of air pollution control equipment as a non-productive capital expenditure. Such a "non-productive" capital expenditure today can well eliminate costly lawsuits, prolong life, assure unimpeded production, improve community relations, maintain product quality, tomorrow. ▲▲

Meetings, Courses, Expositions

Engineering seminar on architectural and engineering planning aspects of atomic shelters, *Pennsylvania State University, University Park, Pa., July 10-22.*

Engineering seminar on structural engineering and radiation shielding aspects of atomic shelters, *Pennsylvania State University, University Park, Pa., July 24-Aug. 5.*

13th International Congress on Occupational Health. *Waldorf-Astoria hotel, New York City, July 25-29.*

Gordon Research Conference on Toxicology and Safety Evaluations, *Kimball Union Academy, Meriden, N. H., Aug. 15-19.*

Special summer program on Noise Reduction, *Massachusetts Institute of Technology, Aug. 22-Sept. 2.*

Western Electronic Show and convention, *Memorial Sports Arena, Los Angeles, Aug. 23-26.*

Production Engineering Show, *Navy Pier, Chicago, Sept. 6-16.*

American Chemical Society fall meeting, *New York City, Sept. 11-16.*

East Central Section, Air Pollution Control Association, *Sheraton-Cadillac Hotel, Detroit, Sept. 22-23.*

Instrument Society of America 15th annual meeting, *New York Coliseum, New York City, Sept. 26-30.*

National Metal Exposition, *Philadelphia Trade and Convention Center, Philadelphia, Oct. 17-21.*

Industrial Hygiene Foundation of America, Inc. 25th annual meeting, *Mellon Institute, Pittsburgh, Oct. 26-27.*

Institute of Boiler and Radiator Manufacturers semi-annual meeting, *Seaview Country Club, Absecon, N. J., Week of Oct. 31.*

National Hotel Exposition, *New York Coliseum, New York City, Nov. 7-11.*

Building Research Institute Fall Conference, *Shoreham hotel, Washington, D. C., Nov. 15-17.*

Air-Conditioning and Refrigeration Institute annual meeting, *Hollywood Beach hotel, Hollywood Beach, Fla., Nov. 18-22.*

Refrigeration and Air Conditioning Contractors Association convention, *Fontainebleau hotel, Miami Beach, Fla., Nov. 20-23.*

24th National Exposition of Power & Mechanical Engineering, *New York Coliseum, New York City, Nov. 28-Dec. 2.*

First Industrial Building Exposition & Congress, *Coliseum, New York City, Dec. 12-15.*

Industrial Heating Equipment Association, Inc. meeting, *Dearborn Inn, Dearborn, Mich., Jan. 23-24, 1961.*

American Society of Heating, Refrigerating, and Air-Conditioning Engineers semi-annual meeting and exposition, *International Amphitheatre, Chicago, Feb. 13-16, 1961.*

National Association of Corrosion Engineers annual conference and corrosion show, *Statler hotel, Buffalo, N. Y., March 13-17, 1961.*

American Chemical Society national spring meeting, *St. Louis, March 21-30, 1961.*

Type Air Filter:

New Filter Medium!

DYNEL filter medium stops and holds unusually large quantities of dirt. Self-sealing, leak-proof assembly completely eliminates problem of filter bypass . . . provides maximum economy at highly acceptable filtration levels.

Saves Change-Over Dollars!

ULOK Cube Filter lasts 6 times longer. Dirt is first trapped on inside face of filter. As dirt builds up, air flow is shunted to large filtering area of four sides. Thus, even after several *pounds* of dirt have been collected, high filtering efficiency and low pressure drop is maintained. This "reverse loading" process increases service life *6 times* over that of conventional filters. Think of the savings in maintenance!

Uses Half The Space!

Medium-size ULOK Cube Filter has a filtering surface of 1040 sq. in.—140 more than a conventional 30″ x 30″ flat filter—yet it presents a frontal area of only 20″ x 20″. Filter bank area can thus be reduced by *half* with medium-depth filter, *even more* with deeper models.

At All Velocities!

ULOK Cube Type Air Filters afford the high filtering efficiency characteristic of low velocity units even in units employing air volumes as high as 1970 cfm!

Proved In Operation!

ULOK Cube Type Air Filters have been soundly proved in numerous installations. Reflecting a complete range of the filtering problems presented under varying operating conditions, these field trials were complemented by extensive and extremely severe laboratory tests.

Ideal for all commercial and industrial air conditioning, heating, and ventilating systems, ULOK Cube Type Air Filters are available in 12 sizes to meet any requirement.

WRITE TODAY FOR FURTHER INFORMATION AND PRICES.

UNION CARBIDE ULOK BRAND

UNION CARBIDE DEVELOPMENT COMPANY

Division of Union Carbide Corporation

270 Park Avenue • New York 17, N. Y.

ULOK and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

10-year Ft. Worth Cooling Study Shows 85,740½-tons Installed

In the past 10 years a total of 9,222 air conditioning systems totalling 85,740½ tons of refrigeration have been installed in Ft. Worth, Texas, according to a study just completed by Texas Electric Service Co.

Conference To Discuss Air Conditioning, Heating of Industrial Buildings

A conference on construction of new industrial buildings and modernization of old ones is slated for Dec. 12-15, at New York City's Coliseum.

Conference will be a feature of the first Industrial Building Exposition and Congress and is sponsored by a board of 28 architects, builders, engineers and industrial executives. Among other topics, Conference will discuss industrial heating and air conditioning.

Cost Of Air Pollution Pegged At $1.5 Billion Annually

Air Pollution in the U.S. is said to cost industry, homeowners, real estate investors and business generally upwards of $1.5-billion a year, according to Carl A. Lindstrom of the U.S.P.H.S. Robert A. Taft Sanitary Engineering Center, Cincinnati. Real estate alone was said to suffer $200-million damage yearly from polluted air.

President Signs Bill For Smog Problem Study

A bill designed as first step toward a program to require exhaust fume control devices on all cars and trucks has been signed by President Eisenhower.

Bill calls for a two-year study of the problem. Bill's author, Representative Paul F. Schenck (R-O.) says he hopes the study will be followed by a law to control injurious fumes, particularly in urban areas.

$4,650,000 Earmarked For Air Cleaning Equipment

U.S. Gypsum Co. is installing about $750,000 worth of air cleaning equipment at its Staten Island, N.Y. plant, according to A. J. Benline, N.Y.C. Air Pollution Control Dep't. Universal Atlas Cement Co., Northampton, Pa., plans a long-range dust control program to cost about one-million dollars. Firm plans to install gas bag collecting houses on three kilns.

Hercules Cement Co., Stockertown, Pa., received bids on dust collection equipment. Project was said to range in cost from $200,000 to one-million dollars.

New Odor "Bloodhound" Tracks Scents To Their Source

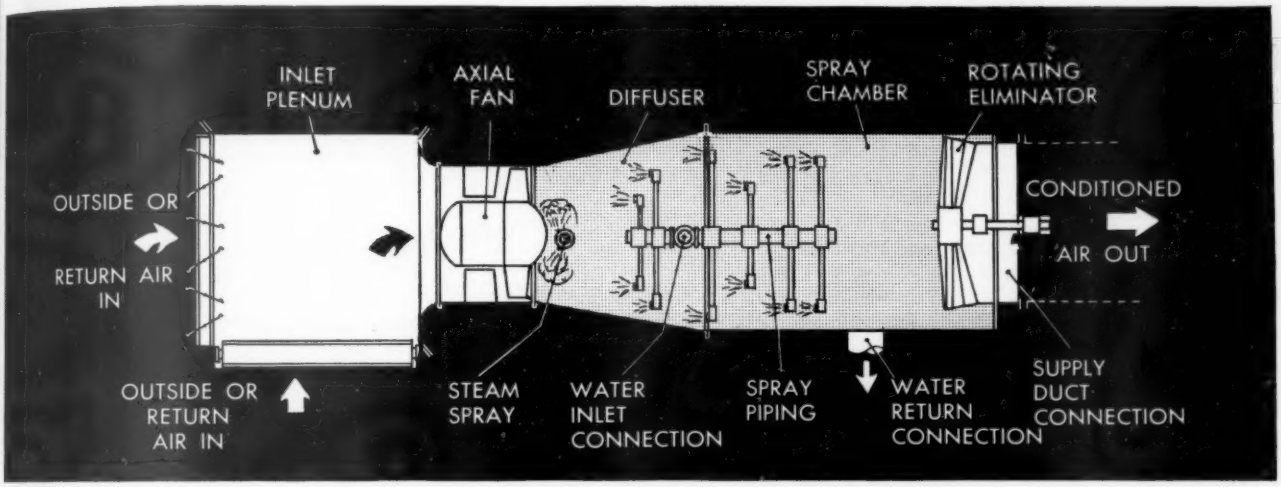
A new device to measure odor intensity is said to be to the field man of an air pollution control force what the bloodhound is to the police detective.

The unit, a refined and improved scentometer, has been developed by the Bureau of Air Pollution Control of the City of Cincinnati, under grant from the U.S.P.H.S.

New scentometer is claimed to be far more accurate in determining an odor's intensity than the human nose. Unit tracks odor to locale of high intensity. Micrometeorological measurements then provide data to trace odor to exact source.

NO AIR FILTERS?
NO AIR FILTERS!

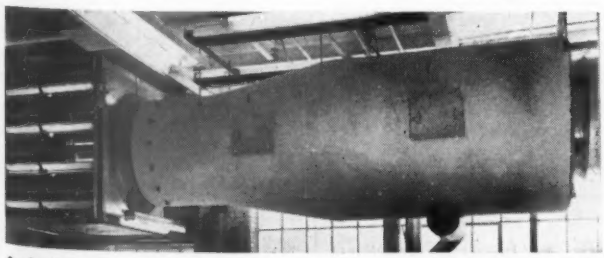
This Carrier Rotaspray Air Conditioner is self-cleaning!



Rotaspray units are self-cleaning and require no filters. Instead of trying to keep dust and coarse particles out as conventional systems do, the Carrier unit lets them enter, separates them from the air and returns them to a central point for automatic collection disposal.

As important as the self-cleaning feature is, it's only one of many ways the Carrier Rotaspray Weathermaker System* has proved itself vastly superior to conventional close-control air conditioning systems. For example:

UNITARY DESIGN. Instead of one large conventional central station system serving several departments, each department has its own Rotaspray unit and can change its temperature and humidity to meet its individual needs.



Carrier Rotaspray Weathermaker units may be installed rooftop mounted, ceiling suspended or outside wall mounted.

SMALLER APPARATUS SIZE. A Rotaspray unit requires less than 1/3 the space of a conventional system of equal capacity.

ELIMINATES MANY SYSTEM COMPONENTS. Units require no water strainer, water pump, water tanks, city water or drain piping. No apparatus room and no floor drains needed.

BETTER HUMIDITY AND TEMPERATURE CONTROL. Eliminates dew point control and its problems. Within Rotaspray System capacity, departments simply "dial" the temperature and humidity required.

In all, there are 17 reasons why it's well worth your while to look into the Carrier Rotaspray System for your plant or process. They range from lower installation costs to superior efficiency and substantial savings in operation and maintenance. For information, write Machinery and Systems Division, Carrier Corporation, Syracuse 1, N. Y.

*Reg. U.S. Pat. Off.

BETTER AIR CONDITIONING FOR EVERYBODY EVERYWHERE

Carrier

NEWS of the Industry

Florida Industry To Clean Air

The Florida phosphate industry will have its air pollution problems under control within two or three years, according to David B. Lee, director of the State Bureau of Sanitary Engineering.

A report to the Florida Air Pollution Control Commission outlined the following steps taken for air pollution control by phosphate companies:

American Agricultural Chemical Company — In-plant controls at phosphate dust conveying transfer points cut dust from dry mill by 40-50 percent. Buell classifier added recently. Financial support requested for control of dust from rock grinding. Study underway to find how to end droplet discharge through stacks at fertilizer plant.

American Cyanamid Co. — Chain-mill for controlling emissions for curing sheds now under construction. Additional dust control plans in process.

Davison Chemical Co. — New diammonium fertilizer plant uses less triple superphosphate, reducing fluoride emissions by about 10 percent. Two-stage scrubber removes excess ammonia, eliminating fluoride emission from this operation, it was claimed. Management has budgeted about one-half million dollars for additional control measures, primarily on curing process.

Armour Fertilizer Plant — Replacement of existing scrubber on dry mill as one unit nears end of useful life. Company is discussing plans for additional control measures.

F. S. Royster Guano Co. — Consulting engineers are investigating possibility of increasing coverage of belt system transferring triple superphosphate to curing process, to trap fluorine from belts, which can be scrubbed.

Company has found market for recovered fluorine, and is installing additional scrubbers and recovery equipment which will reduce fluoride emission from various plant operations.

Swift & Co. — Scrubber in pilot plant stage to control dust.

Smith Douglass Co. — New scrubber to reduce fluoride emission is planned.

Virginia-Carolina Chemical Co. —New Swenson scrubber to be located on new phosphoric acid evaporators, eliminating all gas emission, according to company. In Den area, additional belt coverage will trap fluorine gas, which will be scrubbed. Curing shed emissions are being studied.

Soot Found Related To Lung Disease

A correlation between soot deposits and the lung disease emphysema, was reported in the Journal of the American Medical Association.

In a study of 200 lungs of adult patients who died of diseases other than tuberculosis and lung cancer, Dr. Charles P. Oderr, New Orleans, found the disease usually developed first in small areas of trapped soot.

In emphysema, normal air spaces in the lungs are stretched and the walls are enlarged.

Northern Market Argued For Heat Pumps

Charles V. Fenn, vice president of Carrier Corporation, has predicted that widespread use of reverse cycle heat pumps in northern climates will be one of the significant developments in air conditioning during the next ten years.

"Wider use of modern, intense lighting and business machines, plus the fact that air conditioning permits more people to work comfortably in less space, have created new sources of heat. In fact, so much interior heat is generated it is often necessary to simultaneously cool inside areas while heating outer offices," according to Mr. Fenn.

However, three heat pump manufacturers have taken issue with the intention of some manufacturers to sell heat pumps over the entire country.

"Those companies which you have reported as intending to market heat pumps across the entire country are being overly optimistic," insists the director of engineering of a well-known heating-cooling supplier which has had heat pumps "for as long as anyone except one or two."

"Unrealistic would be a better word for it," adds the vice president of a manufacturing company which is just now field testing a few units, "and is in no hurry to market them without a lot more testing."

There is no such thing as a universally applicable heat pump, insists the president of a third company which has sold heat pumps for several years, but arbitrarily restricts sales to those areas of the United States "which have reached 10° above zero only once in the last five years." A continental map in the home office of this manufacturer shades out most of the country as off limits for heat pump sales.

'Twin Schools' Will Test Economy of Air Conditioning

Pinellas County, Fla., is building two schools with identical educational specifications to determine whether new, fully air conditioned schools can be built at a cost no greater—and probably even less than—non-air conditioned schools, according to a report by American Air Filter Co., Inc.

The schools, designed by different architects, have educational areas 49,159 sq. ft. and 47,880 sq. ft., respectively. Basic construction materials are similar, each has 16 academic classrooms and other similar educational facilities.

The Pinellas Jr. High School, without air conditioning, had a base bid (less cost of a sewerage lift station not included in base bid for comparison school) of $584,749. This works out to a cost of $8.80/sq. ft., or somewhat below the average for schools in the area.

The air conditioned Oak Grove Jr. High School had a base bid of $582,900, or $1,849 less than that for the non-air conditioned school.

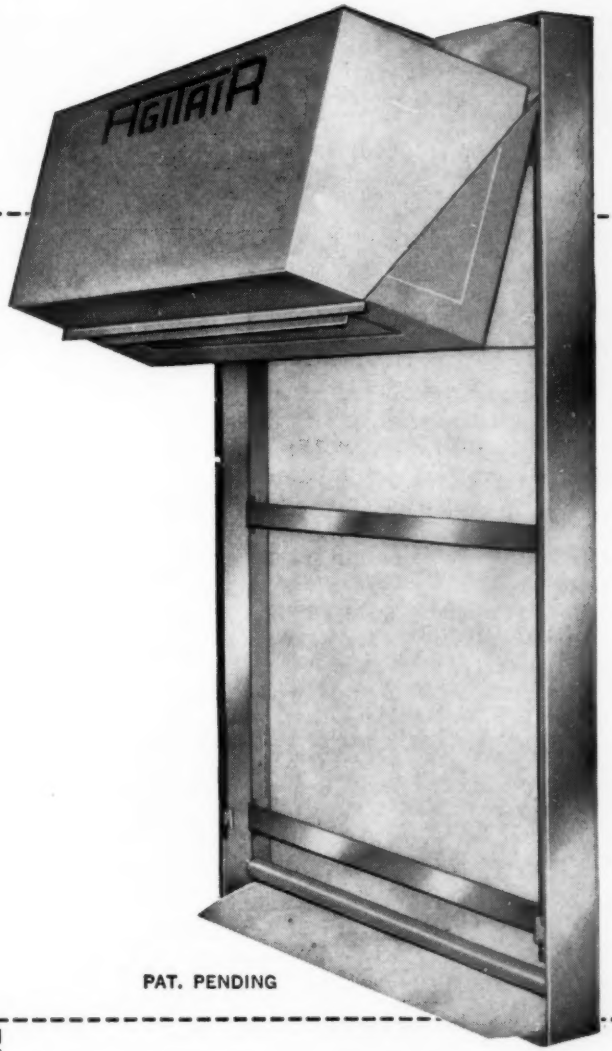
(Please turn to page 16)

NEW PULL DOWN FILTER

CONTINUOUS BLANKET • NO MOTORS • EASY TO INSTALL – SERVICE

AGITAIR®

TYPE "DS"



PAT. PENDING

AGITAIR Type DS Pull-Down filters are engineered to assure the user high dust holding capacity . . . uniform filtering efficiency over the active length of the media with a savings in installation and maintenance costs.

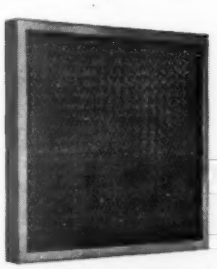
Manually operated, the Type DS eliminates the use of any motors and controls . . . has no moving parts to get out of order . . . easy to install . . . simple to service.

AGITAIR Type DS Pull-Down filters are available in a variety of sizes and capacities to meet your air filtration requirements. For complete data on these units, ask your AGITAIR representative for technical catalog DS-100 or write direct to Air Devices Inc.

ALSO AGITAIR PANEL FILTERS

HIGH VELOCITY
TYPE "FM"

Permanent, cleanable all metal construction. Large dust holding capacity and low resistance. Recommended velocity 533 fpm. Made in 1", 2", 4" thickness. Catalog available.



LOW VELOCITY
TYPE "AP"

Permanent, cleanable all metal construction. Effective filtration – low resistance. Recommended velocity 350 fpm. Made in 1", 2", 4" thickness. Catalog available.

and GREASE FILTERS for kitchen canopies

AGITAIR®

GENUINE PRODUCTS
FOR BETTER AIR

high velocity units . . . air diffusers . . .
registers-grilles . . . filters . . . exhausters

AIR DEVICES INC.

185 MADISON AVENUE
NEW YORK 16, N. Y.

NEWS of the Industry...

(Continued from page 14)

Field Test Data To Be Obtained By Mobile Precipitator

A mobile pilot electrostatic precipitator has been designed and built by the Metal Products Division of Koppers Company, Inc., to obtain for the first time certain engineering data on various power station precipitator operations.

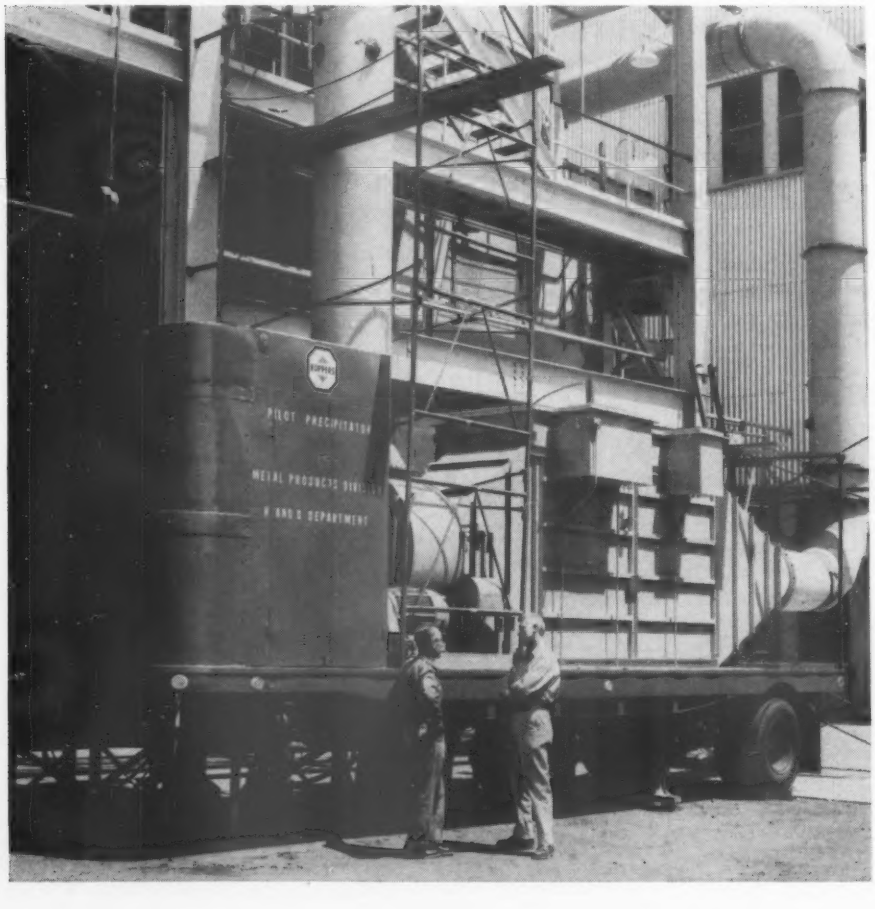
"Initially, the unit will be operated at six carefully selected fly ash installations which will include three different types of boilers burning both eastern and midwestern coals.

"Since the trend in power plant design is toward ever increasing capacity, it is our belief that the data on which we base our present electrostatic precipitator designs may soon be inadequate." D. L. DeVries, manager of the Industrial Gas Cleaning Department of Koppers, said. "We therefore believe it is essential to more accurately evaluate the effect of precipitator operating conditions such as gas velocity, rapping intensity, field length, power requirements, etc.

"It will also be necessary to closely relate the physics and chemistry of the flue gas to these operating conditions and to the physics and chemistry of the coal being fired. We must determine and understand the effect of these factors and how their various interactions influence precipitator performance.

"The only practical way to obtain these functional data on a broad scale is to put a mobile pilot precipitator in the field," Mr. DeVries said. "It was with this in mind that Koppers decided to appropriate the considerable sum necessary to launch this program. In so doing, we expect to gain much valuable information that will be of significant benefit to utilities, Koppers and the industry."

Below: *Truck-mounted electrostatic precipitator obtains field test data. Shown are C. O. Humbert, left, Koppers project engineer in charge of field testing, and James Stallings, control room engineer for Baltimore Gas & Electric Co.*



Symposium Set On Temperature Measurement

A national symposium on "Temperature—Its Measurement and Control in Science and Industry" will be held in Columbus, Ohio March 27-31, 1961, jointly sponsored by the American Institute of Physics, the Instrument Society of America, and the National Bureau of Standards, with other societies and governmental agencies cooperating, it was announced recently.

This will be the first conference of this breadth and scope since the New York conference on the same subject in 1939.

"The symposium will be aimed at the fundamentals of temperature measurement to complement the material in the 1939 volume and will provide an authoritative blending of papers on the meaning of the temperature concept as well as analytical theory, with appropriate emphasis on instrumentation and the engineering aspects, e.g., thermocouples and radiation pyrometry in full range of temperature," it was explained. "Interests from cryogenics to ultra high plasma temperature will also be covered.

"The symposium is being designed to present broad fundamental coverage of the subject for scientific and engineering personnel who are concerned with temperature problems. A reference book based on symposia material will be published."

General chairman of the symposium is W. A. Wildhack, chief of the Office of Basic Instrumentation of the National Bureau of Standards.

Dr. Elmer Hutchisson, director of the American Institute of Physics is vice chairman, and C. L. Roberson, manager of the Mechanical Research Laboratory of the Owens-Corning Fiberglas Corp., is secretary.

Dr. C. M. Herzfeld, chief, Heat Div. of the National Bureau of Standards, is chairman of the Program Committee.

Those interested in contributing to the program should contact Dr. Herzfeld at the National Bureau of Standards, Washington 25, D. C., as soon as possible for details.

(Please turn to page 21)

NEWS of the Industry . . .

(Continued from page 16)

APCA Meeting . . .

Summary Of Selected Papers

The Air Pollution Control Association's 53rd Annual Meeting in Cincinnati, May 22-26, was productive of many valuable and useful papers presented by experts in air pollution control. Our abstracts of seven of the dozens of papers presented at this meeting will give you the "meat" of much new technical data on dust collection, odor control, and air pollution control.

High Temperature Fabric Filtration

Speaking about high temperature fabric filter installations (300-550F) Paul W. Spaite, David G. Stephan and Andrew H. Rose, Jr., all of the Robert A. Taft Sanitary Engineering Center, stated that there are currently about 100 full-scale high temperature installations in use in the U.S.A.

Installed costs for high temperature filter facilities, according to the authors of this paper presented at the APCA meeting, range from $1.00 to $2.50 per cfm, exclusive of gas cooling equipment. Most of the installed units range from 50,000 cfm to 250,000 cfm.

Industries in which high temperature fabric filters could be considered for use include, according to the authors: gray iron cupolas; nonferrous metal fumes in secondary smelting operations, and in smelting, recovering and founding of these metals; perlite processing; carbon black; cement plants; electric arc steel furnaces; collection of aluminum chloride formed by fluxing aluminum with chlorine; removal of talc dust from a carrier gas of superheated steam; control of emissions from a boric oxide fusion furnace and control of sodium phosphate kiln.

Future potential applications were listed as: open hearths; oil-fired power plant boilers; municipal incinerators and steel plant sintering. Other suggested applications include oxygen steel converters; ferromanganese blast furnaces; pulverized coal-fired boilers; scarfing mills; lime kilns; asphalt plants; catalyst recovery units; fluidized coking operations; glass furnaces; chromite ore kilns and electric furnaces used for calcium carbide and phosphorus production.

* * *

How To Control Odors From Soap Making

Manufacture of soap by a St. Louis plant resulted in a serious odor problem over a large residential area of St. Louis. How odor problem was solved was subject of paper by J. E. Molos, department of health and hospitals, St. Louis.

Fish-like odor was not only highly obnoxious, but also had a tendency to adhere to surfaces such as skin and hair, clothing, automobiles, etc., for extended periods of time, said Mr. Molos.

Odor emissions were pinned down to centrifuging operations which could not be totally enclosed; spray tower drier which discharged steam-laden air to atmosphere; storage and Twitchell tanks.

Chemical examination of samples collected at emission sources indicated that odor was due to low boiling point amines which could be odor neutralized by dilute inorganic acids such as sulfuric and nitric.

Problem was solved by use of a company designed control unit which used finely atomized sulfuric acid to scrub discharge from spray tower, and air exhausted from centrifuge room. Twitchell and storage tanks were ducted to air intake for plant steam generators, where combustion temperature was 2300F. Mr. Molos stated that this odor control program is successful.

* * *

Flare Stack For Control Of Process Wastes

Installation of a simple field flare has resulted in significant improvement in odors from off gases from pressurized reactors, and non-condensables volatilized at hot-wells used in vacuum processing systems, according to J. F. Mellor, Jr., American Cyanamid Co.

Flare burns process off gases and non-condensables. Flashback is prevented by water seal pots. Steam from the hot-well vent also aids in achieving smokeless burning, he said. He also recommends accumulating process wash waters, and slowly feeding them to the hot-well for preliminary effluent treatment.

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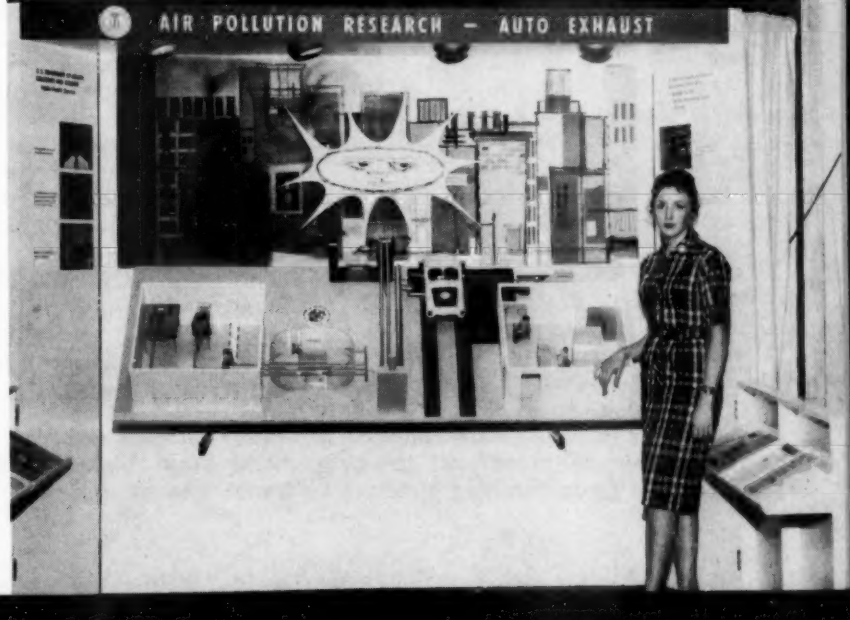


The Robert A. Taft Sanitary Engineering Laboratory, a research and training arm of the U.S. Public Health Service in Cincinnati, had this attractive display at the recent Air Pollution Control Association meeting in Cincinnati. Display shows some of the current research at the Laboratory, including automotive exhausts, air monitoring, dust collection. In the exhibit is Laboratory staff artist Judith A. Walkers, who did the background for the exhibit.

NEWS of the Industry . . .

(Continued from page 21)

APCA Meeting Report . . .

Drone Plane Simplifies Air Probe

An improvement over conventional methods for gathering micrometeorological and air quality data in air pollution research and monitoring programs, was announced by Paul A. Humphrey, U.S. Weather Bureau.

Problem with using high towers is cost of their construction, lack of portability. Captive blimps are hard to maneuver during moderate to strong winds, are deficient in lift during calms. Balloon-sondes pass through layer of interest too rapidly to obtained desired data, are non-recoverable and therefore not suited for costly instrumentation. Manned aircraft are hazardous if operated at low altitudes in urban areas, where most pollution is found.

Mr. Humphrey described a new approach, that of a radio-controlled drone plane, which, equipped with telemetering equipment, can transmit air temperature, relative humidity, and in the future, radioactivity. Digital telemetering equipment will also enable transmission of data on ozone concentration.

According to E. M. Wilkins, meteorologist of Temco Electronics, Division of Temco Aircraft Corp., builders and developers of the drone from specifications supplied by U.S. Weather Bureau, the plane can also carry air sampling equipment such as a Millipore filter, as well as bubblers and midget impingers.

Total payload to date is about five pounds.

Plane can travel up to 4000 feet with a maximum flight duration of 20 minutes at maximum air speed of 20-25 mph. Drone weighs 25 lbs., can be carried in station wagon.

At right: *This portable drone plane is used to take samples of air up to 4000 ft. at up to 20-25 mph. Drone weighs 25 lbs.*

Airborne Grain A Health Hazard

Also at the APCA meeting, Malcolm E. McLouth, chief air pollution engineer, Minneapolis, and Harold J. Paulus, associate professor, School of Public Health, University of Minnesota, stated that of the 500 million bushels of different types of grains shipped into Minneapolis - St. Paul annually, about 37,500 tons are lost to the atmosphere as fine dust particles.

This dust is said to be smaller than 10 microns in diameter, which is the size of dust particle, according to the authors, which would escape from many dust control devices.

This dust emission, they claim, represents a substantial contribution to air pollution load in the vicinity of grain handling plants.

Controls recommended by the authors are: properly designed dust collectors; the baffling of exposed grain drops; use of negative pressures in bins, rail cars and conveyors, and local exhaust hoods at emission points. Bag collectors were recommended for removing dust from the air stream, with return of cleaned air to process area in winter to reduce heating costs. Other measures suggested were: warning devices for cyclone plug ups; easy flowing dust tanks; chemical deodorizers; catalytic combustion of certain gaseous exhausts, incinerators.

* * *

Wet Scrubbers Claimed 99.98% Efficient

For removal of boron oxide particles from high-temperature exhaust gases, the conclusion was reached that wet scrubbers would be most adaptable, according to G. M. Hein and A. R. Orban, Battelle Memorial Institute.

Collection efficiency of 99.98 percent was attained with a wet scrubber in a lab test model. Use of excess water for precooling and saturating stage, and use of high velocity jet stream at exit of burner for injection of saturating water, were most important factors contributing to high collection efficiency. With subcooler nozzles pointed upstream, better efficiencies were obtained, it was reported.

* * *

Scrubber Cleans Open Hearth Exhaust Gas

Pilot plant research on cleaning of open hearth exhaust gas with a venturi scrubber showed considerable promise, according to a report by C. A. Bishop, W. W. Campbell, D. L. Hunter and M. W. Lightner, U.S. Steel Corp.

Report indicated that venturi scrubbers are especially adaptable for open hearth shops where waste heat boilers would be required for temperature conditioning of the gas, where a precipitator is used. Paper describes an installation of a commercially successful venturi scrubber for cleaning open hearth gas at the Edgar Thomson Works of U.S. Steel Corp. on the No. 4 open hearth furnace.

BELYEA NEW APCA HEAD

At the 53rd APCA convention in Cincinnati, Harry Belyea, chief air pollution control officer, Metropolitan Toronto, Ont., Can., was elected president. Belyea succeeds Leonard Greenburg, M.D.

* * *

THREE RECEIVE APCA HONORS

Dr. Robert Kehoe, founder and director of the Kettering Laboratory, Cincinnati, was the recipient of the Richard Beatty Mellon Award "in recognition of his technical and civic contributions to the cause of air pollution control."

Honorary membership in APCA went to Thomas C. Wurts, former APCA president and director, and retired head of the Allegheny County, Pa. Smoke Control Bureau.

William Allen Hamor, Pittsburgh, director of the Mellon Institute, also received honorary membership in APCA.

Pollution Complaint$

Lorain, Ohio — National Tube Co.'s proposed new million-dollar slag plant at its Sheffield Village operation is under fire from area residents and village officials as a potential source of more slag dust.

• • •

Eugene, Ore. — Oregon State Sanitary Authority, Air Pollution Control Div., is collecting and analyzing samples downwind from the Byrnes Asphalt Paving Plant.

• • •

Coos Bay, Ore. — City Council of Eastside is concerned about deposition of cinders, flyash and wood fibers from Georgia Pacific Corporation's lumber mill plant at Coos Bay. Company officials indicated corrections were underway.

• • •

Buffalo, N. Y. — City of Buffalo has appealed to New York's Governor Rockefeller, in a letter by John C. Quinlan, Buffalo deputy public works commissioner, about airborne gases from Bethlehem Steel Co.'s plant. Mr. Quinlan said that "something should be done to alleviate airborne gases from chimneys of this plant which leave deposits of red rust." Quinlan stated he directed the appeal to the governor because past efforts to get results from State Division of Industrial Hygiene proved unsuccessful.

• • •

Clawson, Mich. — Area residents have petitioned city councilmen for action to end what they have termed excessive fumes, dust and noise, and auto paint damage from iron oxide fumes from Expert Steel Treating Company. Other complaints from residents include headaches, nasal and chest congestion, smarting eyes and house paint deterioration.

• • •

E. Liverpool, Ohio — Mackintosh-Hemphill Division of W. E. Bliss Co. has been asked to discuss with City Council ways and means of eliminating air pollution from furnaces.

• • •

Salem, Ore. — Oregon Pulp and Paper Company was notified by Oregon Air Pollution Authority that emissions of sulfur dioxide and other sulfur compounds were creating public nuisance downwind from their mill.

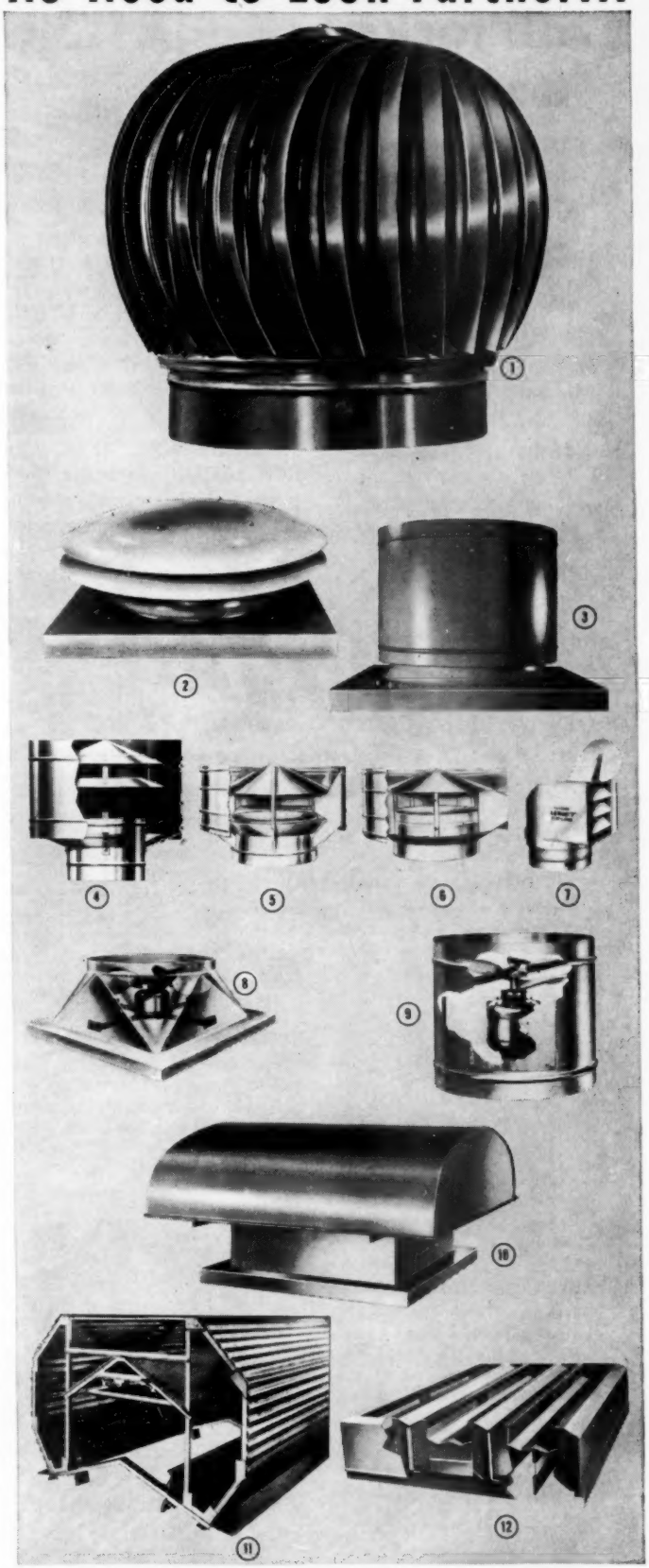
• • •

Youngstown, Ohio — City Smoke Control Engineer Walter I. Rauh has asked officials of Youngstown Sheet and Tube Co., Republic Steel Corp. and U.S. Steel Corp. to submit plans for eliminating metallic fumes from open hearth furnaces.

• • •

Cincinnati, Ohio — To control odors . . . Hilton-Davis Chemical Corp. is spending at this time some $100,000 in odor control by amines, phenol recovery unit and drier. Phenol odors are the problem.

No Need to Look Further...



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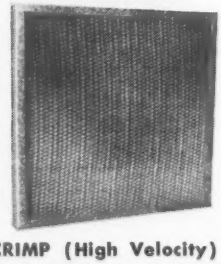

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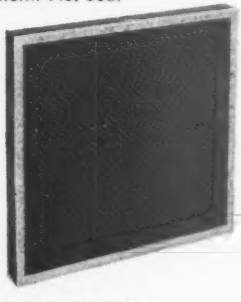

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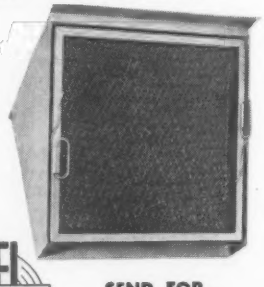

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Prior Death Wins Lawsuit

By Howard Newcomb Morse
Counsellor at Law

FRANK CROPPER was employed as a laborer by the Titanium Pigment Company in its chemical manufacturing plant in St. Louis. He was engaged in operating a reduction tank, in which there was used poisonous acid. Gilmanite ore and sulphuric acid were put in the pans of the digest department. The pans were placed in a furnace until the solution boiled. Then the pans were removed from the furnace and emptied into a trough which ran into the reduction tanks. The hotter the mixture was made in the furnace, the hotter it was when it reached the tanks. This determined the amount of fumes and gases that would escape.

In the performance of his duties, Cropper was compelled to inhale the fumes arising from the solution in the tank. On July 3rd, this caused serious injury to his lungs. He filed an action in the District Court of the United States for the Eastern District of Missouri against Titanium to recover damages for his injuries.

The superintendent of Titanium testified that sulphuric dioxide gas was not poisonous, that he had never heard of a man dying from sulphuric dioxide gas and that no one had ever died in Titanium's plant from such poisoning. His attention was called to the death of Bernard Pumpelly, who had died on the premises of Titanium on April 14th, almost three months prior to the time Cropper was injured. The superintendent denied that Pumpelly had died from sulphuric dioxide poisoning.

Other witnesses produced by Titanium testified that there were no fumes or gases of any kind in its plant. Titanium used several expert witnesses who testified that they had made tests of the air subsequent to the time Cropper left Titanium's employ and found no gases or fumes of a poisonous nature in the air.

In response to this testimony, Cropper, by his attorneys, produced a certified copy of the death certificate of Pumpelly. The certificate, under the heading "Cause of Death," stated the following: "Accidental. Overcome by fumes from sulphur dioxide gas. Titanium Pigment Co., Inc., St. Louis Co." Cropper's attorneys offered the death certificate in evidence.

Counsel for Titanium objected to the certificate being admitted in evidence for the reason that it was irrelevant and raised a collateral issue. The court sustained the objection and rendered judgment for Titanium. Cropper appealed on the ground that the court erred in sustaining the objection.

The United States Court of Appeals for the Eighth Circuit reversed the decision of the lower court. The Court of Appeals declared: "True, the issue in this

(Please turn to page 53)

? ? ? ? ? ? ? *Questions & ANSWERS* ? ? ? ? ? ? ?

QUESTION:

"What instrumentation is available for the detection of carbon monoxide in enclosed areas?"

I.M.K.
Albuquerque, N. M.

ANSWER:

The maximum allowable concentration for carbon monoxide for an 8 hour exposure is 0.01 percent by volume (100 parts CO per million parts of air). Therefore from the hygienic standpoint the instruments for detecting carbon monoxide must be highly sensitive and capable of detecting minute quantities of the gas.

There are currently on the market a number of instruments sensitive enough to detect and determine concentration of carbon monoxide in hygienic concentrations. These instruments range from chemical colorimetric indicating tube equipment costing less than $50.00 up to highly sensitive recording equipment costing several thousand dollars. A brief description of some of the equipment commercially available for quantitatively determining CO is as follows:

(A) *Detectors utilizing chemical tubes producing a color change.*

This type of detector uses a single-use tube containing chemicals which change color when air is passed through them. A rubber squeeze bulb or a plunger type pump meters the air through the glass tube containing the color producing chemicals. The concentration is determined by comparing the color change with color comparison chart giving various concentrations of CO. In one instrument the length of stain or color change is compared with a chart giving concentration of CO. This equipment is reliable and initially inexpensive. It is sensitive enough to determine concentrations well below the hygienic level.

(B) *Continuous direct reading portable indicators.*

This detector is battery, manual, or line power driven. It continuously samples the air and indicates the concentration on a direct reading a dial giving concentrations from 0.00 to 0.15 percent; concentrations can be estimated to about .001 percent. The instrument catalyzes CO to CO_2 by means of a catalyst, Hopcalite.

The reaction produces heat and is measured by differential thermocouples in series with a millivolt meter calibrated in percent CO. The instrument is portable and weighs from about 17 lbs. for the line

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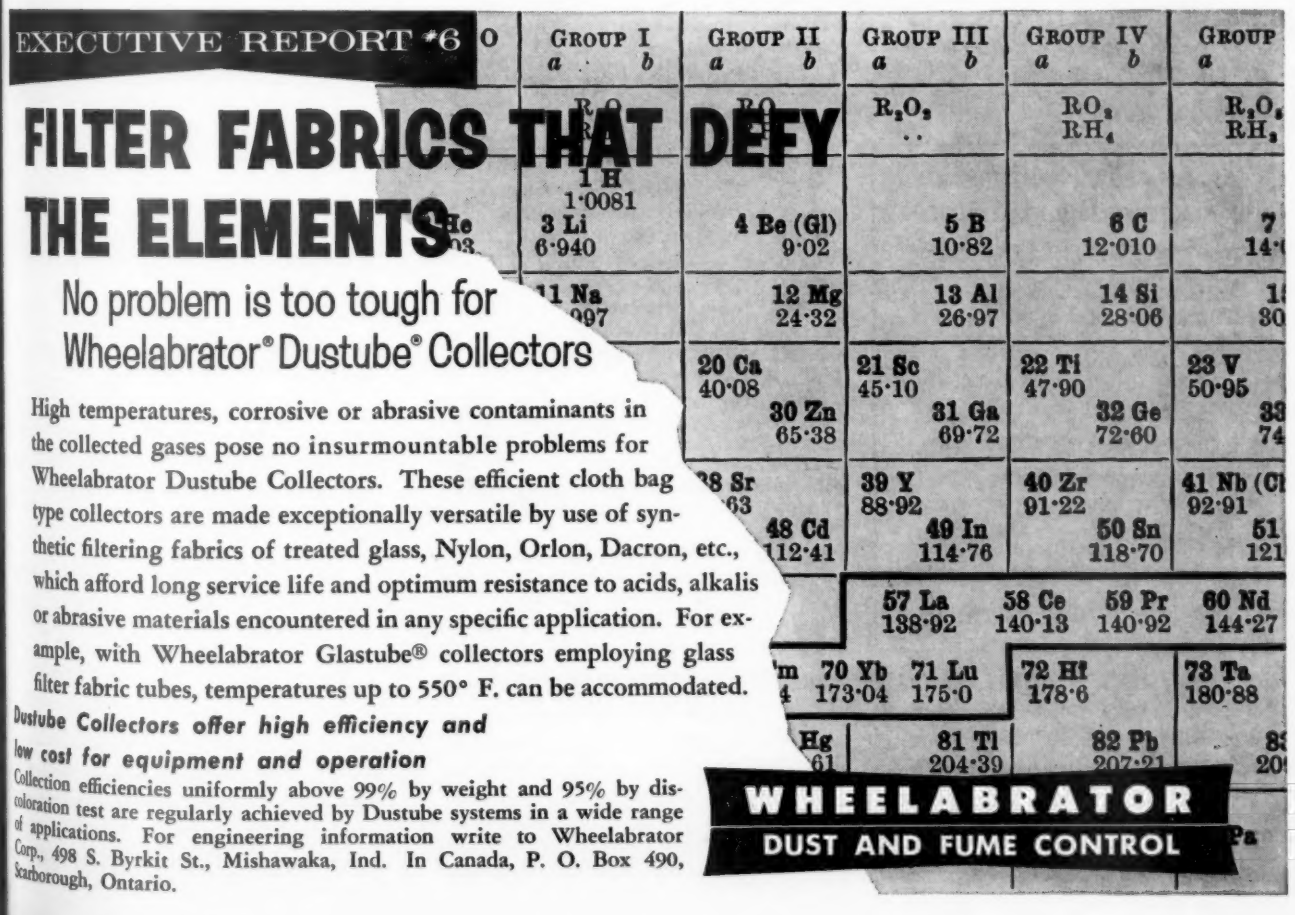
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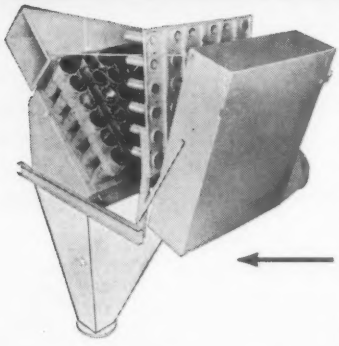

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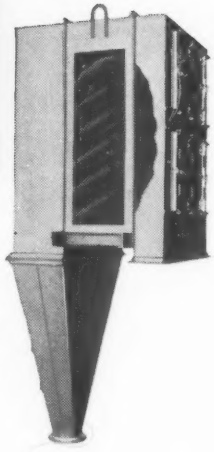

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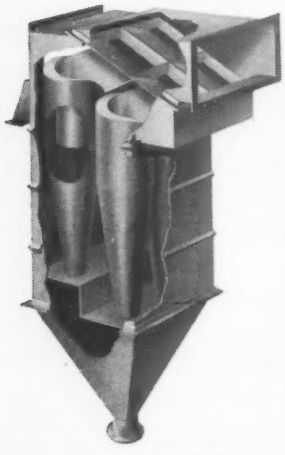

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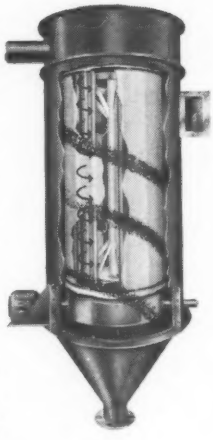

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Letters

Wants New Smoke Guide

Editor:

Our city uses the Ringlemann chart to measure smoke density. Is there a quicker and better method to do this?

H. J. Burger
Sanitarian
Janesville, Wis.

Editor's Note:

City of Detroit Air Pollution Control Department uses a hand-held colorimetric scale for determining degree of air pollution from autos, trucks, buses, etc. Scale is a four color printing of actual smoke emissions, and as such gives a quite accurate picture of unacceptable emission conditions. Scale is for use by relatively untrained personnel such as policemen for checking auto exhaust. Scale can be obtained from Morton Sterling, chief, Air Pollution Control Dep't., City-County Building, Detroit.

A handy and accurate smoke gauge is one put out by the U.S. Public Health Service. It can be hand-held, and reflects the difference in background light and the smoke under study. Gauge can be obtained from Andrew Rose, Robert A. Taft Sanitary Engineering Laboratory, 4676 Columbia Parkway, Cincinnati, Ohio.

Another simple, hand-held smoke density guide is one that permits direct optical comparison of smoke and a smoke density indicator. It may be obtained from K. W. Knoelk, Manager, Incinerator Sales, Plibrico Co., 1800 Kingsbury St., Chicago 14, Ill.

Correction

Editor:

In the May issue of Air Engineering, on page 60, column three (Report on BRI Seminar, talk by Louis C. McCabe) 1.a should read 30 lbs/1000 lbs oil . . . not 100 lbs/oil.

S. H. Judd
Industrial Hygienist
Standard Oil of California
San Francisco

Editor's Note:

Mr. Judd is correct.

Use Communications Center, page 37, for requesting more information about articles, advertised products, literature, etc.

Fig. 1: *Discharge of fluorine, SO_2 and SO_3 mists and flakes of silica fluoride emissions were controlled at V-C company by this low velocity, cell type wet scrubber, designed by firm's engineering department.*

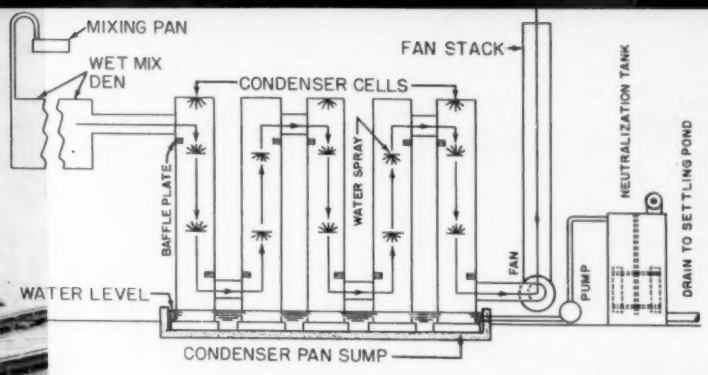


Fig. 1A: *Scrubber shown in Fig. 1 is diagrammed here. Unit consists of five wood staves in series, with a 6000 cfm induced draft fan at discharge end, discharging into a 30 ft. stack.*

At Virginia-Carolina, $62,000 in . . .

Pollution Control Equipment Pays Off In Two Years

by Frank Richter
Chief Engineer
Virginia-Carolina Chemical Corp.

Tough air pollution control problem at V-C's Memphis plant is solved with novel collector design. System pays for itself in two years through product savings, more production, better working conditions, and improved formulation.

HERE IS A TWO-FOLD air cleaning problem in a plant located in the middle of a densely populated residential and small business area, where emissions of gases, dry dust, moist dust and wet solids polluted the air.

The plant is the Virginia-Carolina Chemical Corporation, Memphis, Tenn. This article will describe two processes which caused air pollution . . . the acidulation of ground phosphate rock dust with sulphuric acid . . . and the chemical mixing of dry phosphates and potash with liquid nitrogen. The nature of the emissions from each process and how these emissions were controlled are detailed.

The first process, acidulation of ground phosphate rock dust with sulphuric acid, was equipped with an injector type gas scrubber. This was 80 percent efficient, allowing fluorine as $H_2 S_1 F_6$ and traces of SO_2 and SO_3 as a mist to be discharged into the air. Also wet flakes of silica fluoride were discharged. This effluent is irritating to eyes, nose and throat tissues and the wet flakes of silica fluoride are corrosive to most material. There is no value of this material, at this plant location, as a reusable substance.

Numerous complaints were filed with the City of Memphis Health Department and with our Plant Superintendent, citing burning sensations in eyes and respiratory system. The air pollution affected the area within plant boundaries and also the surrounding neighborhood, especially on humid overcast days.

The injector type scrubber was replaced with a low velocity cell type, wet scrubber, designed by Virginia-Carolina Chemical Engineering Department.

(Please turn to following page)

Fig. 2: *Dryer collector inspection doors.*

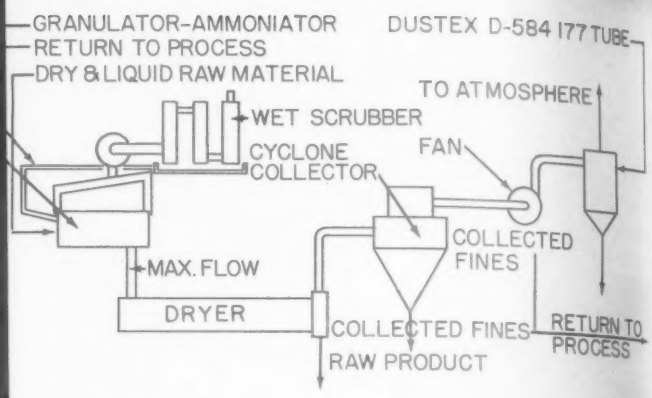


Fig. 2A: *Dust collection system on dryer and granulator. Unit is a multiple tube collector on exhaust side of fans.*

(Continued from preceding page)

This unit was designed to absorb the fluorine and precipitate the solid silica fluoride flakes with 99 percent efficiency.

The unit (Figs. 1 and 1-A) consists of five wood stave tubes in series, with a 6000 cfm induced draft paddle impeller fan at the discharge end. The fan discharges into a 30 ft. stack.

The entire unit is supported on a 15 ft. x 21 ft. x 12 in. deep concrete pan, lined with acid proof brick laid in Pennsalt HF Mortar. The tube sizes are 24 ft. x 4 ft. ID and are luted about 8 in. in the pan.

Each tube is fitted with spray discharging countercurrent to the air flow. Two 12 in. baffles are in each tube, spaced 7 ft. apart on opposite sides of the tube to prevent channeling of the gas stream and also to pulsate the flow of gas as the baffles increase the velocity of the gas, due to restriction of the tube at baffle points.

The velocities of the gas are:

1. Capture at production unit $\frac{6000}{3.98} = 1500$ fpm
2. In 48 in. dia. tubes $\frac{6000}{12.57} = 480$ fpm
3. At baffle points $\frac{6000}{10.12} = 593$ fpm
4. Exit stack $\frac{6000}{5.8} = 1030$ fpm

Pressure drop across system = 4 in. w.g.

There are 13 sprays in the five tubes using 100 gph each.

$$13 \times 100 = \frac{1300}{60} = 21.61 \text{ gpm}$$

Spray water is recirculated and fresh cold water makeup is 15 gpm.

The overflow from the pan is pumped into a neutralizing tank and Cal-Mag is added. The neutralized liquor is conducted to a settling pond.

Results

Fluorine in the discharged gas stream is reduced to eight parts per million.

Silica fluoride as a solid is precipitated 100 percent to condenser pan.

The installation will not pay for itself, but is a necessity to continue operating in this City.

Second Pollution Problem

The second process, granulation of fertilizer, involved collection of dry dust from a rotary dryer, a rotary cooler and gas and dust from a liquid-solid reactor unit.

The materials to be collected are not toxic, are reusable and are returned to process. The size of the dust particles varies from passing 300 mesh screen to 14 microns. The temperature, water vapor and volume of dust effluent, were a factor in the problem of efficient collection.

The collection of dust had to be a dry process, as water used in the collection of the dust to be returned to the manufacturing process would upset the different formulas, as varying amounts of water are needed for each formula manufactured.

The outside air pollution and the carry of dust by prevailing winds towards residential areas was the cause of numerous complaints. On damp cloudy days the superintendent was forced to shut down production.

The manufacture of granular fertilizer involves three major processes:

1. Weighing and mixing dry and liquid fertilizer components.
2. Chemical reaction of the components.
3. Drying and cooling the finished product.

The second operation takes place in a reaction chamber called an ammoniator granulator and is the

Fig. 3: *Photo shows the cooler dust collector.*

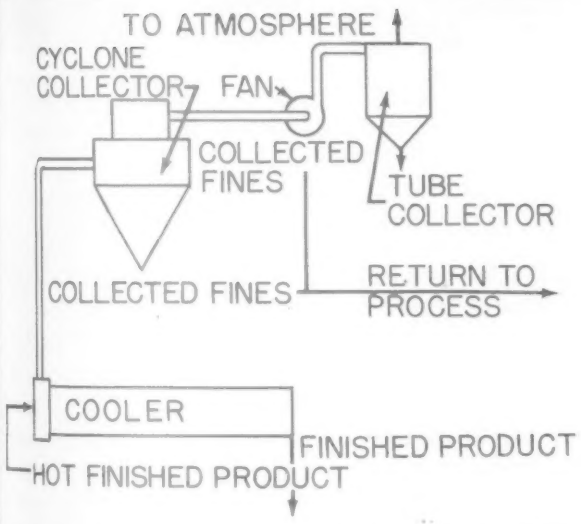


Fig. 3A: *Flow chart of cooler dust collector system.*

chemical mixing of dry phosphates and potash with liquid nitrogen solutions and 66 Be' Sulphuric Acid.

Certain reactions take place with resultant release of endothermic heat, 180F to 200F, and the liberation of free ammonia, water vapor, ammonia chloride and possibly some oxides of nitrogen.

There is also a small amount of 20-plus micron dust particles emitted from this operation. This problem was solved by the installation of a wet scrubber (Figs. 2 and 2A) similar to that described in the acidulation process, but having a smaller capacity. The water used for scrubbing is returned to process, as it has some chemical value.

From the granulator the raw product (see step 2 above) is fed into a horizontal rotary dryer fired by a gas furnace, counter-current air flow, thence to cyclone type dust collector, operating on the suction side of a centrifugal fan, thence exhausted to atmosphere. The gas at this point has a temperature of 120F to 130F.

The product from the dryer is classified and then put through a rotary horizontal cooler having counter-current air flow. The air and dust from this unit was treated identically to that from the drying operation.

The installed cyclones were discharging all dust particles smaller than 100 microns into the atmosphere, causing a serious problem, as the dust loss was 2 percent of 20 tons per hour of production or 800 pounds per hour.

Solution

The installed 10,000 cfm cyclones were unable to collect dust particles smaller than 100 microns. After investigating all types of dry collectors, as to initial cost, potential maintenance and replacement costs and manufacturer's guaranteed performance, it was decided to install multiple tube collectors (Figs. 3 and 3A) on the exhaust side of the fans;

177 tube collector on the dryer
120 tube collector on the cooler

The 177 tube collector has a capacity of 18000 cfm @ 5.1 in. w.g. pressure drop and 125F.

The 120 tube collector has a capacity of 12000 cfm @ 5.1 in. w.g. pressure drop and 125F.

The breeching, flues, cyclone and 177 tube collectors on the dryer were insulated to prevent a drop in temperature below the dew point, within the collection system.

The cooler collection equipment was not insulated.

The 25 hp fan motors were replaced by 40 hp motors, and the speeds of the fans were increased to compensate for additional resistance of the tube collectors.

Dryer 790 rpm to 930 rpm
Cooler 760 rpm to 925 rpm
The dryer stack velocity is 2290 fpm
The cooler stack velocity is 1900 fpm

Space in the building was a factor in the selection of a compact collector in order to use as much of the original installation as possible.

(Please turn to page 53)

CREDITS

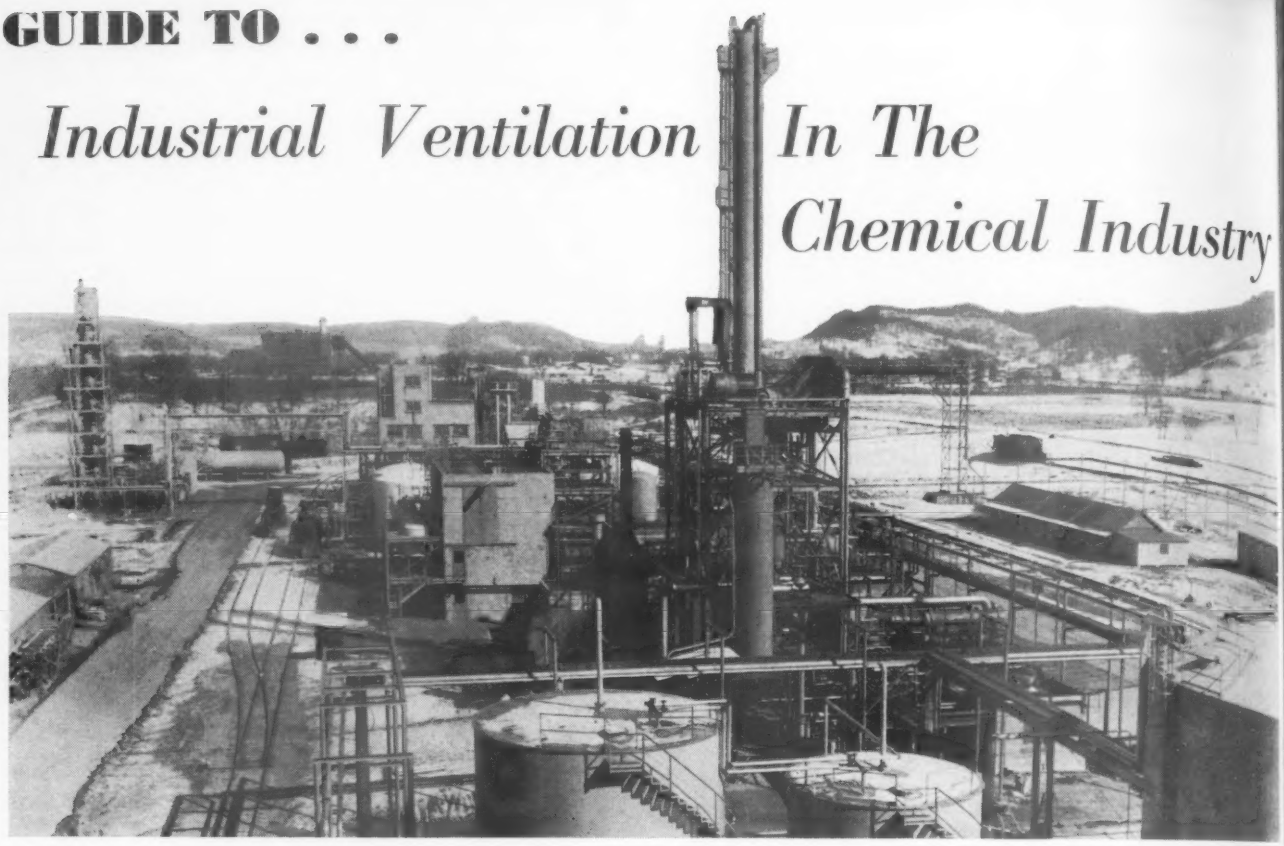
Design Engineering . . . *Engineering Department, Virginia-Carolina Chemical Corporation.*
In Charge of Operations . . . *J. C. Edge, Plant Superintendent, V-C Corp.*
Installations . . . *Virginia-Carolina Chemical Corporation Plant Engineering Department, Memphis Plant.*

EQUIPMENT

D-584 Tube Collectors . . . *Dustex Corporation.*
#629 Fans . . . *Sturtevant Div., Westinghouse Electric Corp.*
Wood Stave Condenser Tubes . . . *Design by Virginia-Carolina Chemical Corp., Fabricated by Wendnagel Co., Chicago.*

GUIDE TO . . .

Industrial Ventilation In The Chemical Industry



View of American Cyanamid Co.'s new aniline manufacturing facilities at Willow Island, W. Va. Plants such as these require careful design of ventilating systems to maintain employee health.

By William V. Andresen
Chief Industrial Hygienist
American Cyanamid Co.

For control of dust when packaging chemicals from hammer mills and pulverizers, batch milling, bag filling, drum and barrel filling . . . this article gives ventilation design system tips.

THE PACKAGING OF SOLID MATERIALS into drums or barrels is often accompanied by the liberation of toxic or irritating dusts which must be controlled.

The material may be transferred directly to the drum from process equipment such as hammer mills, ribbon blenders, cone blenders and dryers or the material may be transferred to an intermediate surge or storage bin before the containers are filled.

Transfer of the solid product to the container through a vertical open chute of any substantial length should be avoided. Extremely large volumes of air are induced by the falling of solid particles through chutes. Transfer of the material into an intermediate surge bin will solve the air aspiration problem. The use of a rotary air lock or other sealing device on the chute will also reduce the large air volume induced.

The packaging of product directly from hammer mills to drums, although far from ideal from a materials handling process, is sometimes necessary. In industries where many products are made in batch quantities, the duplication of hammer mills or other process equipment for each product is not economical.

Therefore, one equipment installation may be used to process a number of different products. If cross contamination is a factor, the installation must be made as simple as possible to facilitate cleaning between different products. For batch milling or pulverizing, direct discharge of product from the mill to a drum rather than into a surge tank is simple and the installation is relatively easy to clean between products.

Hammer mills and other types of pulverizing equipment which operate at high speed, induce air by a centrifugal fan action. Factors which influence the air volume induced are the speed of the rotor,

***WILLIAM ANDRESEN** is chief industrial hygienist for the American Cyanamid Co. A graduate engineer, he is vice chairman of the Bergen County, New Jersey air pollution control committee. He is also a delegate from the National Safety Council to the American Standards Association committee Z-9 on industrial ventilation. He is a member of the American Industrial Hygiene Association.*

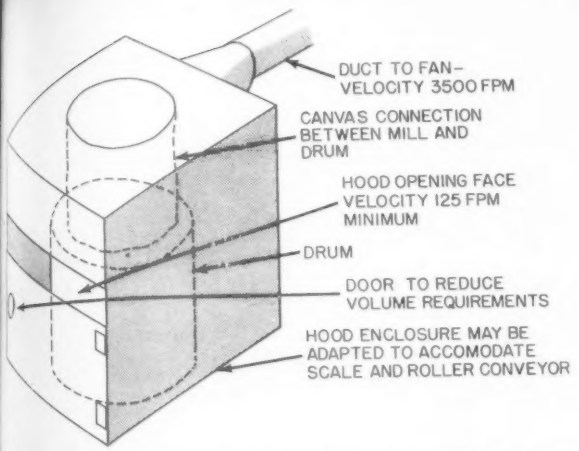


Fig. 1: *Hood for control of dust during drum filling from mill. Total volume required = volume induced by mill + volume for 125 fpm face velocity.*

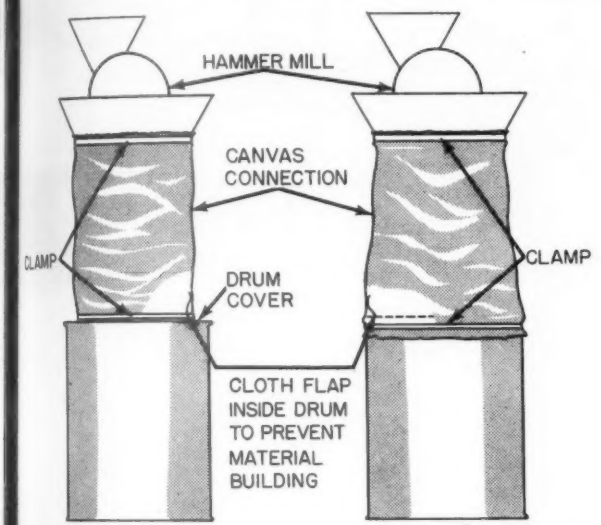


Fig. 2: *Drum cover adapted by cutting hole in top and welding a cylindrical metal piece to cover canvas connection fastened by clamp to cover and mill.*

Fig. 3: *Canvas connection is fastened directly to drum and mill by clamp or elastic.*

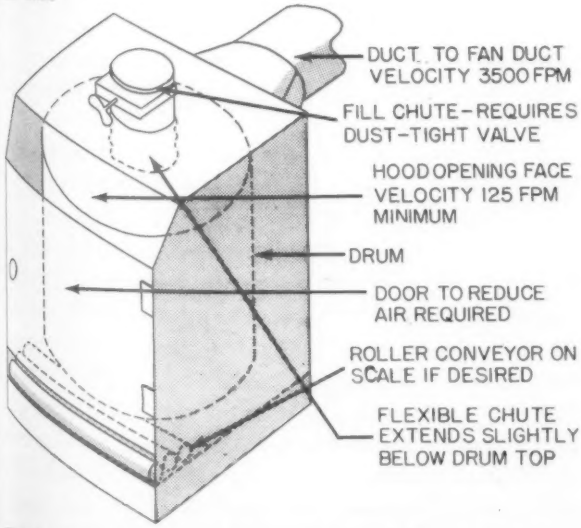


Fig. 4: *Hood enclosure for drum filling. Drum cover may be placed on drum through opening. Roller conveyor for ease of drum removal scale, if it is desired to weigh to exact weight. Minor drum weight adjustment may be performed within hood.*

number and dimensions of hammers and the feed mechanism and method of feed. The air is induced at the feed of the mill or through ports in the mill housing.

Maximum induced air will occur when the feed is at a low rate or when the mill is emptying. There are several methods by which air entrainment by mills may be reduced. These will be discussed in a later article. Some manufacturers can furnish the air volumes which their equipment entrains. W. C. L. Hemeon in his reference book *"Plant and Process Ventilation"* describes a formula for estimating the induced air volume. Volume between 150 cfm-4000 cfm have been measured by the writer at hammer mill installations.

It is evident then that the air volume induced must be known and that to realize satisfactory dust control, it is necessary to exhaust this volume as well as the volume necessary to maintain the desired control velocity for a hood.

The air induced by the mill is in intimate contact with the product being ground and when vented will contain large amounts of dust. This may represent a sizeable percentage of yield if it is allowed to be exhausted directly from the control hood. To reduce dust loss, a tight canvas (cloth) connection may be made between the mill and the container. Air that is exhausted from the mill passes through the canvas, and larger dust particles are filtered out.

In some cases, use of the canvas connection alone will provide satisfactory dust control. However, if the dust is toxic or irritating, or if good housekeeping is desirable, hood enclosure of the drum is desirable. Fig. 1 shows the general design of a hood enclosure and cloth connection between the mill and drum. The connecting of the cloth to the drum may be accomplished by adapting a drum cover as part of the connection (Fig. 2) or the cloth sock may be connected directly to the mill and drum (Fig. 3). A hood face velocity of 125 fpm should be used.

When drums or barrels are filled from storage bins, discharge chutes from the bins are usually equipped with rotary valves or slide gates to start and stop flow. Dust tight feed equipment is available and should be used.

Several different types of hoods can be utilized for control purposes. Fig. 4 shows a booth or hooded enclosure with a door to reduce the open hood face and therefore the control air volume required. If the door is not designed as part of the hood, a larger air volume will be required.

Excellent control of dust from most drum filling operations from bins can be realized by an air flow of 125 fpm across the hood opening. The hood enclosure is often designed with a weigh scale platform inside the hood so that the drum may be filled exactly to shipping weight and a dusty weight adjustment operation avoided.

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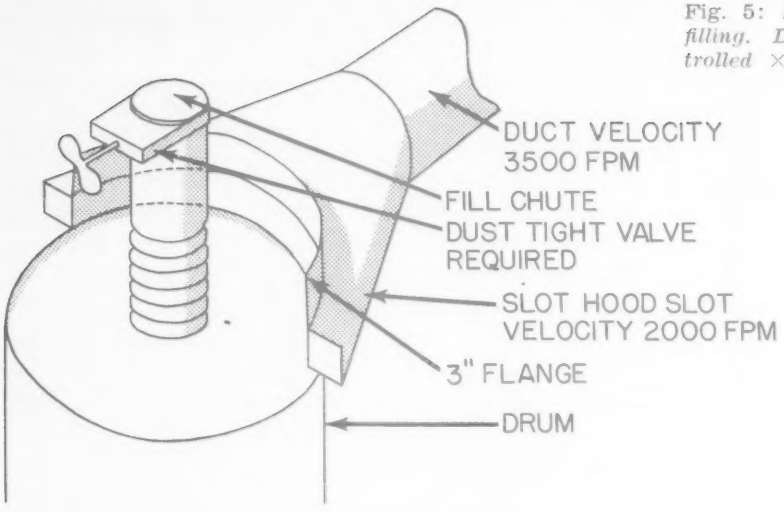


Fig. 5: *Slot hood for dust control during drum filling. Drum control volume = area to be controlled × 150.*

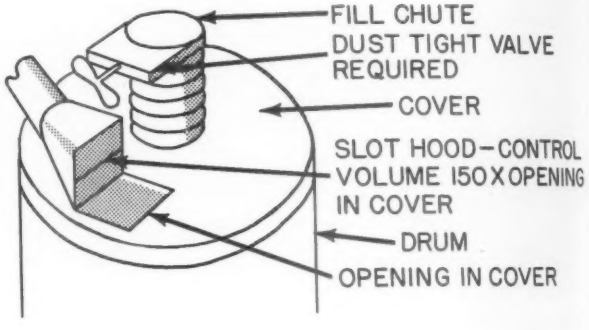


Fig. 6: ***Here is a modified slot hood ventilation set-up for chute filling.***

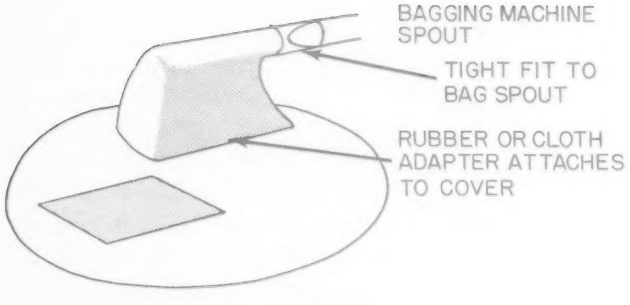


Fig. 7: *Left, dust control set-up for bag filling operation.*

(Continued from preceding page)

Provisions may be made to allow drum weight adjustment within the hood and therefore under control. The opening in the hood should be designed to allow the covering of the drum within the hood. A roller conveyor section may be installed within the hood to facilitate the entry and removal of drums.

The filling chute should extend slightly below the drum top to reduce dust losses. This can be done using a small section of flexible duct.

Excellent control of dust from drumming operations can be realized using slot hood type of ventilation as shown in Fig. 5. The control air volume requirement may be calculated by multiplying the area to be controlled by 150. The slot hood should be designed to encompass as much of the circumference of the drum as possible. Good control can be realized during filling, weight adjustment and the covering of the drum with the slot type ventilation. However, if any product spills from the drum, or if the fill chute leaks, dust from these sources may constitute a problem. In the booth enclosure type of ventilation, spills and leaks are confined within the enclosure.

Fig. 6 shows a slot type hood used in conjunction with a drum cover. An opening in the cover just large enough to observe the filling operation is required. The slot hood may be attached directly to the cover adjacent to the opening. A relatively small control air volume is required approximately 150 cfm per square foot of opening. The drumming operation may be done directly on a scale with the weight of the cover and hood as part of the tare. The cover may be counterweighted for ease of removal. This type of installation has been used to control dust when drums are filled from valvepak bagfilling equipment. An adapter for the bag filling spout as shown in Fig. 7 is used in conjunction with this slot-hood and cover.

The use of a canopy type of ventilation for the control of dust from drumming operations is shown

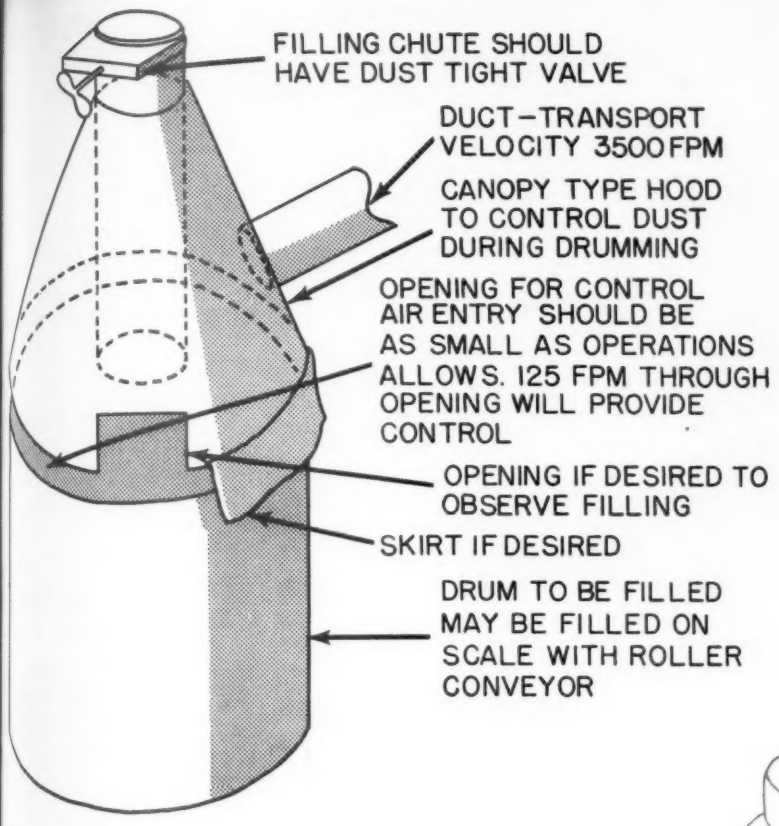

FILLING CHUTE SHOULD HAVE DUST TIGHT VALVE
DUCT–TRANSPORT VELOCITY 3500 FPM
CANOPY TYPE HOOD TO CONTROL DUST DURING DRUMMING
OPENING FOR CONTROL AIR ENTRY SHOULD BE AS SMALL AS OPERATIONS ALLOWS. 125 FPM THROUGH OPENING WILL PROVIDE CONTROL
OPENING IF DESIRED TO OBSERVE FILLING
SKIRT IF DESIRED
DRUM TO BE FILLED MAY BE FILLED ON SCALE WITH ROLLER CONVEYOR

Fig. 8: ***For drum filling, this set-up will provide excellent dust control.***

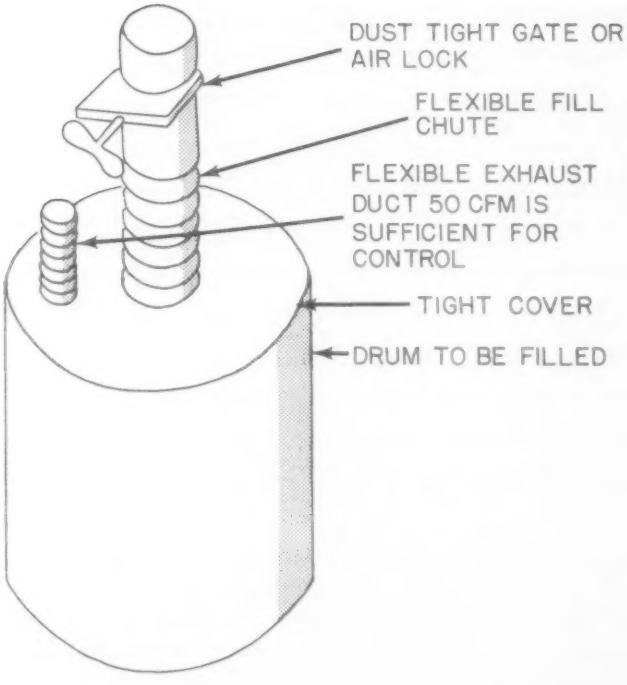

DUST TIGHT GATE OR AIR LOCK
FLEXIBLE FILL CHUTE
FLEXIBLE EXHAUST DUCT 50 CFM IS SUFFICIENT FOR CONTROL
TIGHT COVER
DRUM TO BE FILLED

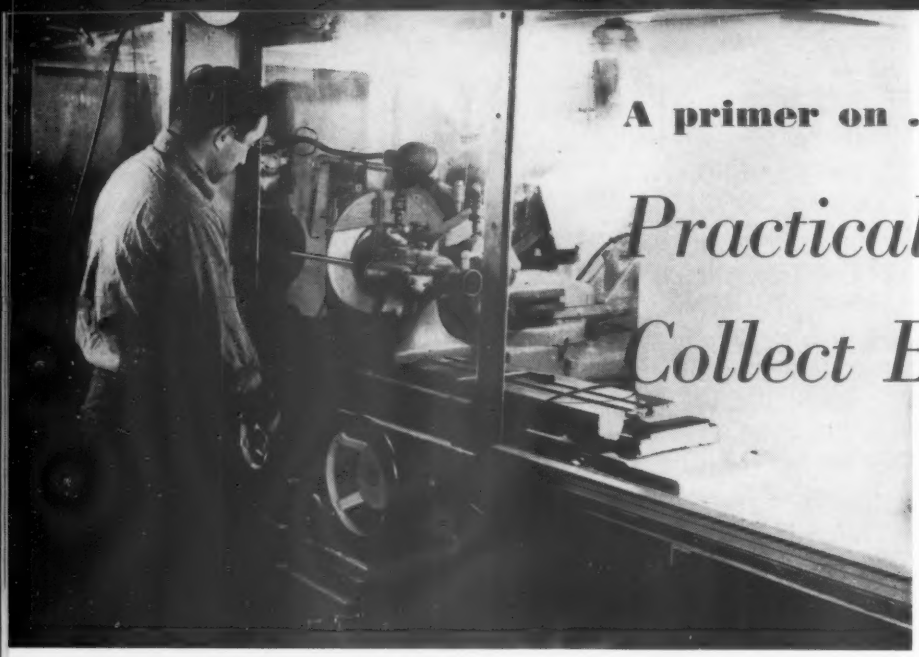
Fig. 9: *Draw-through ventilation for drum filling uses flexible duct.*

in Fig. 8. It is desirable that the bottom of the canopy be located with a few inches of the drum top to utilize a minimum volume of control air. 125 cfm per square foot of opening will usually provide satisfactory control. The canopy may be modified to provide an opening through which the operation may be observed. With this type of ventilation, the drum cover may be placed on the drum while it is under the influence of the control air. Drums may be filled to desired weight on a scale with this type of ventilation also.

Dust control of drumming operations may also be accomplished by tightly covering the drum and exhausting the required control air directly from the cover. This method is the least desirable for several reasons. The direct exhaust is conducive to excessive dust losses.

Dust may be created when the cover is removed from the drum. On occasions, dust adheres to the cover and periodically falls off contributing to atmospheric dust and housekeeping problems. Fig. 9 shows this type of control. An air volume in the order of 50 cfm is usually adequate for control.

The centrifugal type fan is usually utilized for applications involving dust handling often in conjunction with a dust collector. ▲▲



This simple enclosing hood has a transparent, vertically sliding access panel which is fully closed during operation to prevent escape of high-speed dust particles generated by cylindrical grinding of metallic beryllium.

A primer on . . .

Practical Ways to Collect Beryllium Dust

PART I

by A. J. Breslin and W. B. Harris
Health and Safety Laboratory
U.S. Atomic Energy Commission

Here's 10 year's experience in beryllium dust collection. Hood design, enclosure techniques, air flows, local exhaust ventilation, process ideas, are just a few of the many practical methods presented. There's an answer to your beryl ventilation problem whether you machine, grind, vacuum cast, sinter, fabricate, sublimate, chlorinate, fuse or reduce metal from salt.

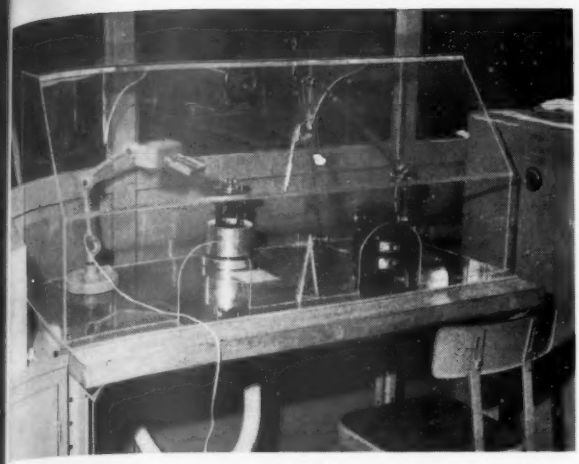
AT PRESENT THE ONLY proven way to prevent sickness at a plant processing beryllium or its compounds is to maintain rigid control of the beryllium concentrations in the environmental air.

Three forms of disease are known to be associated with the production and processing of beryllium materials: acute respiratory illness, chronic respiratory illness, and certain kinds of skin reactions. Respiratory illness develops from the inhalation of airborne beryllium dust, fume, or mist, whereas the skin reactions occur from direct contact of some compounds with the skin or implantation under the skin. Of the two types of exposure, inhalation is certainly the more serious, and respiratory illness resulting from inhalation of relatively small quantities of beryllium have terminated fatally; however, both kinds of exposure may result in serious loss of working time.

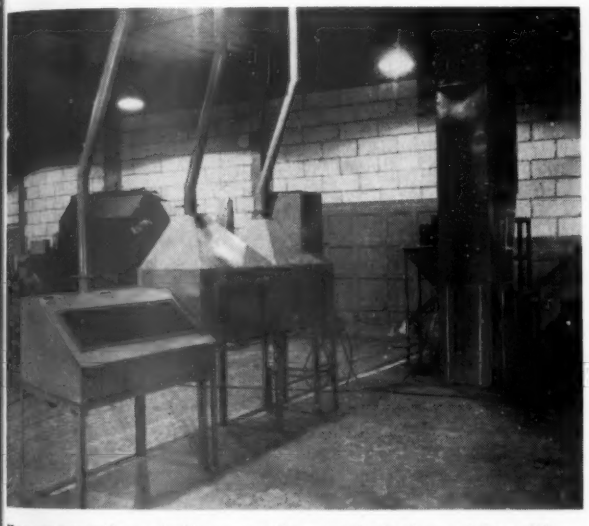
Respiratory illness has been found among residents near beryllium plants as well as among industrial workers. Thus, careful control of beryllium discharged into the air from the plant is as important as is control of beryllium dust at beryllium operations within the plant. This control has been treated in a previous paper.[1]

For beryllium workers the average daily exposure should not exceed 2 $\mu g/M^3$, and transient peak concentrations should not exceed 25 $\mu g/M^3$. For out-of-plant air (neighborhood exposure) the concentration averaged over a month should not exceed 0.01 $\mu g/M^3$.

Operator is sorting and sieving beryllium pebbles and chips. Hood is made of sheet metal and clear plastic. Air is supplied at 150 fpm and 150 cfm. Hinged slant panel at front is opened only for maintenance. Classified material may be dropped into containers through holes in hood bottom. Flexible tubes, permanently mounted over openings, may be attached to containers.



This set-up is used for production deburring of machined beryllium metal parts. Hood is of clear plastic, with air velocities at 300 to 400 fpm through each hand opening. Air volume is 200 cfm. Exhaust is through a downdraft grate shown in bench center. Deburring is performed directly over grate.



Here pneumatic grinding, sorting and sieving of beryllium pebbles and chips is done in enclosed hoods. Hoods of sheet metal and lucite are supplied air at 350 to 400 fpm at face of vertical hoods; to slant face hoods air is supplied at 100 to 200 fpm. Air volume to vertical face hoods is 500 to 600 fpm; to slant face hood, 600 cfm. Two hoods at right are interconnected. A pneumatic grinder is in the most remote hood. Ground metal is transferred to adjacent hood internally for classifying. Doors are closed when foot treadle actuated grinder is in use.

AEC control recommendations applied at facilities under contract to the Commission permit excursions above these concentration values, but only for limited periods. The stated concentration maxima are admittedly stringent, but they can be achieved through the application of engineering controls.

The following sections describe in detail the components of a control program and cover process designs and operations, and experience gained by the Health and Safety Laboratory at a variety of beryllium installations.

Plant design and operation must be geared to eliminate direct contact with beryllium materials and to maintain air concentrations within the limits previously specified. In areas where either of these conditions cannot be met, suitable secondary means must be provided to prevent excessive exposure. Among these are protective gloves and clothing, protective skin creams, and personal respiratory protection. Wherever a choice exists, however, primary control should be selected.

The attainment of an average air concentration of 2 $\mu g/M^3$ or less imposes considerably greater restriction on operating techniques and entails far more extensive control equipment than that required for more common toxic substances. Therefore, it has been found generally advisable to segregate beryllium activities if other kinds of work are also being performed at the same installation. This restricts exposure to a limited number of individuals and permits the exercise of greater control over work procedures and the movement of beryllium materials.

The engineering tools required to control atmospheric contamination within the beryllium process areas consist of:

1) The selection of process components that will release the smallest possible quantities of contamination.

2) Application of local exhaust ventilation at all points of potential contamination release.

3) Careful operating procedures.

4) Thorough housekeeping.

5) Provision for suitable personal protective measures.

Each of the components deserves equal emphasis. It would be a mistake to neglect any of them in setting up controls for a beryllium facility.

The responsibility for effecting safe plant operation rests with the engineer who must design equipment for good dust control and stipulate operating procedures consistent with minimal dusting. He must also do routine monitoring of beryllium dust concentrations to be assured that adequate control is continually in effect. It is advisable that this work be delegated to a competent industrial hygiene engineer.

Although the individual control methods are not uncommon in industrial practice, an industrial engineer inexperienced with toxic dusts generally will not be aware of the high order of control that must be built into, and maintained at, a beryllium process.

Adequate control is generally more easily accomplished where proper design measures are integral with new plant design. The modification of an operating facility where overexposures exist may be more formidable in terms of cost and engineering skill than the proper design of a facility at its inception. Frequently problems are encountered in a modification program which result from existing equipment that is inherently difficult to control. However, modifica-

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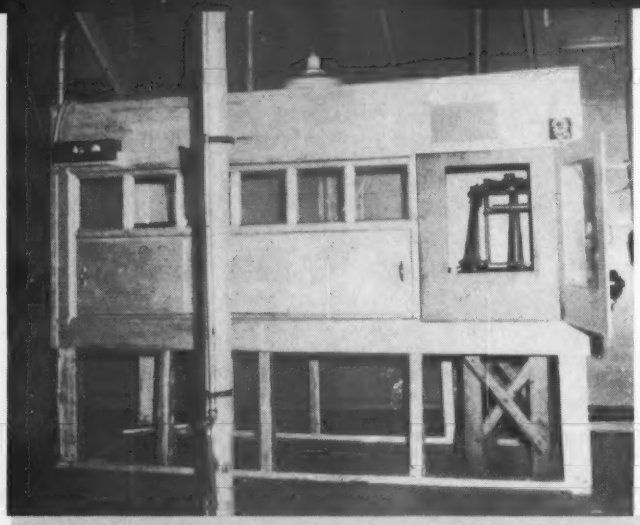

Photo shows a pilot plant operation for general purpose use. Hood of plywood and glass is supplied air at 150 fpm and 150 cfm. Hood is used for transferring, weighing, sieving and blending small quantities of finely divided beryllium compounds. Rotap is at right end. In sliding panel arrangement at left, both panels cannot be fully opened simultaneously, limiting total open hood area. Contaminated surfaces of inside panels are never exposed.

Hood is used for transfer of finely divided beryllia from metal trays to silica trays. Tiers of tray storage racks are mounted within hood at rear. Glove ports prevent operator contamination of gloves and sleeves. Unique feature is glove-port mounting which slides on roller suspension to any position in front of hood, allowing operator to transfer trays within hood without restriction. Air velocities are 200 fpm.

tion has been accomplished satisfactorily in several installations where unfavorable conditions had existed.

Process Design

Air contaminants are controlled by ventilation, and it is evident that required air capacities and the complexity of hood design are functions of the type of process and the details of its operation. Thus the establishment of good control must begin with the process itself. When undertaking to design a new facility or to install controls in an existing one, the first step should be to investigate the process with an eye to eliminating inherently dusty equipment and operations to the greatest possible extent. This will tend to simplify the designing of the ventilation, which is the next step.

It is quite obvious that the processing of dry, finely divided material will create far more dust than that of wet material. But the complexity of control required for the dry process will be directly related to the handling methods used. For instance, there might be a choice between a manual and an automatic transfer system. Each may be controlled, but the ventilation necessary for the former method would generally be more complex and less effective than for the latter.

In the layout of a process every effort should be made to minimize the number of operations that present potential escape routes for dust. A few basic principles should be borne in mind.

1) *Manual handling should be reduced to an absolute minimum.* This recommendation cannot be overemphasized. Experience has repeatedly shown the majority of high dust concentrations in beryllium plants to be associated with manual tasks. This finding is certainly not unique to beryllium operations, but these specific dust sources are particularly manifest at beryllium facilities because of the generally low air dust concentrations. Where manual operations are necessary, they should be properly ventilated.

2) *It should be assumed that every implement which has been in contact with beryllium is contaminated and therefore a potential dust source.* Contaminated implements should not be removed from the hoods in which they have been employed until thoroughly cleaned. Frequently there are several locations in which one particular implement is needed. In this case it is preferable to provide a duplicate at each location rather than to transfer one implement back and forth. It is also possible in some cases to group operations so that they can all be controlled by a single ventilated enclosure and thereby obviate

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An engineering analysis of industrial applications . . .

Packaged Heat Pumps vs Conventional Systems

by J. Orr
Air Conditioning Division
Westinghouse Electric Corp.

If heat loss and heat gain of your plant are nearly equal, heat pump may be an economical answer. This article tells why and compares package heat pumps with built-up conventional cooling systems.

FOR COMMERCIAL AND SMALL INDUSTRIAL PLANT installations, the all-electric heat pump not only provides a combustion-free heat and air conditioned plant, but also affords an economical design approach heretofore unavailable except in residential installations.

The pros and cons of heat pumps for industrial heating and air conditioning can be evaluated by examining a typical application.

With the increasing march of industry into the Piedmont section of our Southeast, the problem of providing adequate manufacturing space is a pressing one. In many cases, the manufacturing facility is financed and built using local capital; and leased to the occupant on a long term basis. Where private and public funds are so used for manufacturing space, the various elements of the over-all general contract costs come under close scrutiny.

Fig. 1 shows the medium size industrial plant of the D. D. Bean & Sons Company, manufacturers of safety bookmatches in Winston-Salem, N. C. The low-cost nature of the product makes it imperative that a very efficient manufacturing operation be maintained, and that the plant overhead be held to a minimum. For maximum employee year-round comfort, the Wall-Turner Company, at Winston-Salem, N.C., installed an air-to-air remote heat pump system in this modern factory.

Factors Affecting Design

In evaluating the application and arriving at the most practical heating and air conditioning system

Fig. 1: *Plant of D. D. Bean & Sons, matchmakers. Plant is heated and cooled with heat pumps.*

design, several approaches to the problem were considered. The factory building was to be customary slab floor, 12 in. concrete block wall, and built-up flat roof construction used in most present day factory construction. The roof was to be a bar-joist type with white stone topping over ½ in. rigid insulation on 2 x 6 in. T & G decking.

Such a factory construction lends itself well to virtually any type equipment layout. In this case, the following basic approaches to a year-round comfort heating and air conditioning system design were considered.

1. A field-assembled system with multiple suspended air handling units.
2. Multiple self-contained packaged air conditioners.
3. Multiple air-to-air remote heat pumps.

An analysis of the manufacturing operation, that of the manufacture of book or safety matches, shows that several design considerations are in order. The match "body" is stamped from roll paper stock before being sent through a convey dip. The match head is applied by dipping into a vat of sulfur and potassium chlorate, followed by a dipping in paraffin to give a moisture resistance coating to the match head. The bookmatch cover is cut and printed in a separate operation; with the final operation being automated stapling of the match body in the cover, and final boxing.

After the application of the match "head," the match is passed through a 30 minute drying operation in a series of overhead convey tracks. The "drying" operation places a latent requirement on the system of 40 quarts of water per hour. Ventilation require-

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ment for the manufacturing operation was one room air-change per hour. The manufacturing lighting load is approximately two watts per sq. ft. of floor space.

A floor-to-ceiling open storage area at the front of the building was originally laid out for wall separation from the remainder of the manufacturing area. However, a late change resulted in leaving the storage area open to the manufacturing area. In load evaluation for equipment sizing, the storage area perimeter was treated as an exterior wall, with tentative plans for adding two heat pumps should future manufacturing call for use of the area as a machinery area.

A breakdown of the calculated load resulted in:

	Office Area	*Manufacturing Area*	
Total Heat Gain	2.8 ton	40.8 ton	(at 95F outdoor summer ambient)
Total Heat Loss	44,500 Btuh	445,000 Btuh	(at 10F outdoor winter ambient)

Equipment Arrangement

The air-to-air remote heat pump is installed with the outdoor section located on a concrete slab adjacent to the rear wall of the manufacturing area. The air-handling unit is suspended in the manufacturing area from the roof bar joist (see Fig. 3). The two system components are connected with a liquid refrigerant line and an insulated vapor line. Six remote heat pumps are used on the manufacturing area, and one is used on the office area.

The indoor section (air handling unit) of the six 7½ (nominal) ton remote heat pumps conditioning the manufacturing area is suspended horizontally on drop rods from the roof bar joist. Conditioned air is discharged out the 4-way adjustable discharge grille, blanketing the manufacturing area with filtered, conditioned air. Mounted 13 ft. off the floor, each unit has an effective air "throw" to 60 to 75 ft. with an air-spread along the ceiling which will settle into the working zone (0 to 7 ft.) without creating uncomfortable drafts.

Return air is brought back to the unit with intake through the filter section in the rear of the air handling unit. A fresh air duct connection extending through the rear wall, provides up to 20 percent fresh air circulation for indoor ventilation.

The indoor section of the 3-ton heat pump handling the office area is horizontally suspended above the office drop-ceiling, with ceiling supply and high-wall return. A condensate line is run from the air handling unit, through the exterior wall, and down to grade level. Location of the outdoor units at grade level facilitates easier service than roof-mounted equipment.

The main electrical power circuits in the plant are a three-phase, 440-volt, and a three-phase, 110 volt fluorescent lighting circuit. In order to place the remote heat pump on the most economical operating

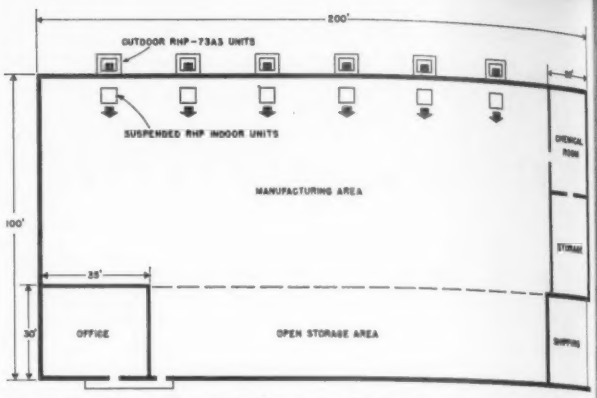

Fig. 2: *Plant layout showing location of suspended unit reverse cycle heat pumps.*

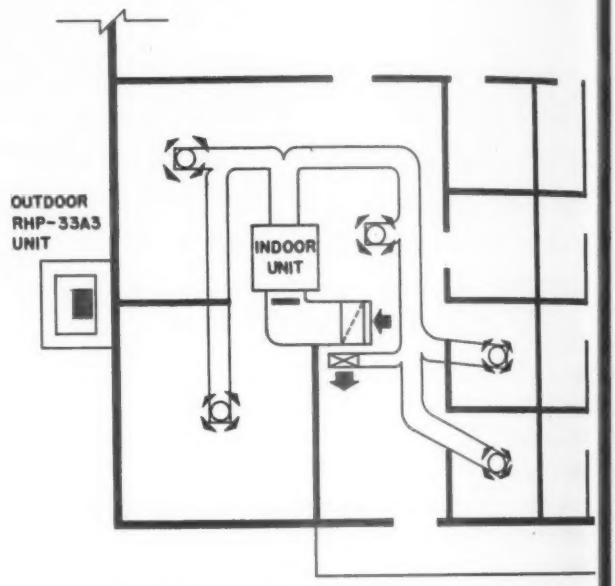

Fig. 2A: *Details showing office area layout.*

basis, and to avoid expensive transformer voltage step-down, the auxiliary strip heat (i.e., booster heat) was placed on the building 440-volt service. The 3-step auxiliary heat was balanced across each phase, and the indoor section fan motor and the outdoor unit were placed on conventional 220-volt. Appropriate disconnects were installed adjacent to the indoor and outdoor units. The proximity of the suspended indoor unit, and the slab-mounted outdoor unit permit close-coupling the indoor and outdoor units and relatively short runs of power and control wiring.

Operation of each remote heat pump is controlled from a heat-cool thermostat located on the wall adjacent to each suspended air handling unit. The thermostatic operation of the remote heat pump is automatic "heating" or "cooling," with constant fan operation available for mild weather ventilation.

During heating operation, the first stage of the two-stage heating thermostat controls operation of the heat pump compressor for heating output, dropping into the second stage of heating when the auxiliary heating elements are called for. Three outdoor thermostats located in a weather enclosure on

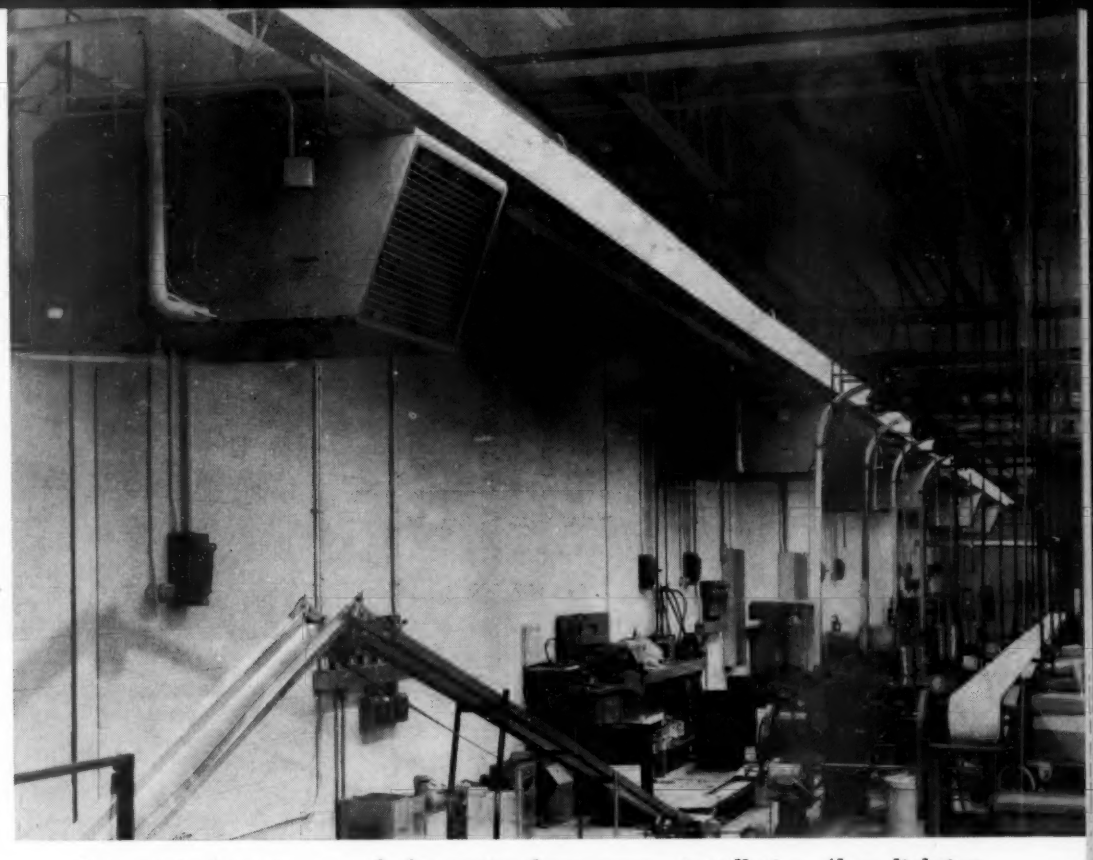

Fig. 3: *Ceiling suspended package heat pumps in D. D. Bean & Sons plant.*

the outside wall will call for auxiliary strip heat in three steps, based on the outdoor air temperature, and the control of the desired indoor temperature. By sequencing the auxiliary heat, more economical operation is achieved and the kilowatt load is lowered.

The three-ton remote heat pump conditioning the office area is controlled from an indoor thermostat located in the accounting area.

Summary

The application of remote air-to-air heat pumps on this installation actually affords the most simplified and economical system available, considering first installed cost and system operating cost. In fact, many similar manufacturing concerns, where the total heat gain and loss is compatible with the capacities of heat pump available on the market today, lend themselves very well to an all-electric heating and air conditioning system. Generally speaking, where the ratio of total heat "gain" to heat "loss" is from 1.50 to 1.00, the air-to-air heat pump is definitely a practical approach to an economical heating and air conditioning system, depending on the local industrial kilowatt rate structure. Economical heat pumping operation can be expected when an equipment "balance point" (winter outdoor temperature to which the heat pump without auxiliary heat will handle the installation load) of 32F or lower is experienced.

In the case of the D. D. Bean plant installation, installed cost for the heat all-electric pump was less than a dollar per sq. ft. of floor area, compared to a comparable built-up system utilizing a hot water boiler for heating of approximately $2.50 per sq. ft. of gross floor area. Estimated monthly operating cost of the entire heat pump installation (less lighting, machinery loads, etc.,) is expected to be competitive, based on an effective industrial kilowatt rate of approximately 1.2 cents per kwhr.

With the present skyrocketing industrial expansion, the industrial air conditioning market is looked upon by many as the next "big" heating and air conditioning market. Not only will new plants lean heavily toward complete year-round air conditioning as a production efficiency "boost," but existing plants will as well. Recent surveys show that no more than 10 percent of existing plants are air conditioned (other than the office area). With soaring labor and materials cost, smart management is looking at year-round employe comfort as an economical and reasonable answer to increased employe efficiency and increased profits. As little as two percent increase in production efficiency can pay for air conditioning for most manufacturing operations. ▲▲

CREDITS

Architect: *D. D. Bean & Sons*
General Contractor: *Wilson Covington Construction Company, Winston-Salem, North Carolina*
Mechanical Contractor: *Wall-Turner Company, Winston-Salem, North Carolina*
Major Equipment: *Six Westinghouse RHP-73A3 Remote Heat Pumps*
One Westinghouse RHP-33A3 Remote Heat Pump

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For instrumentation assembly, MIT lab has a new

Design For White Rooms

by **Robert J. Schiesser**
Section Leader, Instrumentation Laboratory
Massachusetts Institute of Technology

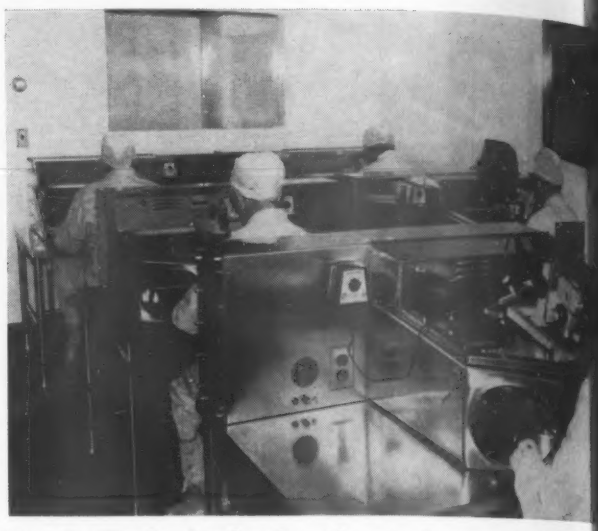

Fig. 1: *Newly developed enclosures in use at the MIT Instrumentation Laboratory were designed at the laboratory to meet the needs of inertial guidance systems assembly in a particle-free atmosphere. Fabricator of the equipment incorporated highly polished welds and coved corners to assure ease of particle removal.*

This description of MIT's white room includes fabrication and structural material, utilities, air flow, filtering systems, and other data vital to white room enclosure data.

INCREASINGLY STRINGENT REQUIREMENTS for ultra-precision assemblies, which require almost complete freedom from dust particles, have emphasized the need for effective enclosures in which these components can be assembled.

Although it has been borne out that particles interfere with the operation of an extremely delicate unit, such as an inertial guidance system, standards regarding the maximum size or particle allowable are not well defined. As a result, most work of this nature has been done on an empirical basis; in our M.I.T. Instrumentation Laboratory for example, we have been using the hypothesis that any particle, visible under a 40 power microscope with adequate lighting, cannot be tolerated.[1] In addition, there is also a lack of standards[2] for the enclosures; and therefore, a wide number of different enclosures varying greatly in both practicality and effectiveness has been developed.

Requirements for the enclosure and the whole general assembly area will be affected by a balance between economy considerations, the level of particle freedom desired, and production quotas. In many cases from the entire range of commercially available enclosures, not one will be found to suit the needs of a particular user. As a result, the laboratory or other facility responsible for producing precision parts will itself have to design the enclosure that fills its specific needs. The degree of filtration of the environment of the assembly operation is inversely related to the time required to clean the parts. The cost of man hours for cleaning must be weighed against the cost of extra-high filtration requirements.

The ultimate design of a dust-free enclosure should follow several basic principles: (1) Positive pressure is applied to prevent dirty air from entering the enclosure through the openings; (2) Physical comfort of the technician takes on increasing importance as the tediousness of his job grows; and (3) The "white room," which houses the enclosures, exerts a significant influence on the level of cleanliness within the enclosures. Occasionally, a facility will attempt to fabricate a "home-made" enclosure for a specific purpose; but in most cases, the lack of refined fabricating techniques results in a unit that is unacceptable.

Enclosure Design

The facility that requires an enclosure not available as a standard item will probably find it most expedient to draw up a preliminary design and consult with a highly qualified commercial fabricator. Deficiencies within the resulting prototype can then be determined; and with revision, a satisfactory enclosure will result.

For example in developing an enclosure for gyro assemblies, we drew up a preliminary design; constructed a wooden model; contracted with S. Blickman, Inc., Weehawken, New Jersey, to turn out a prototype based on the design. A preliminary enclosure was ordered to determine if any further change would be required before the order was to be completed. This work was done under Air Force sponsorship relative to the development of precision naviga-

final systems. The required number of enclosures is now in operation; and although effective, the units still are being refined with minor modifications.

Dimensional Requirements

To facilitate painstaking cleaning, inspection, and assembly operations, the ability of the technician to reach all areas of the work surface deserves careful consideration. Reference to standard dimensions for the typical U.S. male and female will prove an aid in determining the height of the enclosure, location of work openings, etc. At the Instrumentation Laboratory, we specified that the microscope mounted on the enclosure and the work area be located between the lap and eyes of all technicians at the laboratory. As a result, it was necessary to lower the working surface from a maximum of 30 in. to 28 in. and adjust the mounting of a standard microscope to meet this requirement.

The work area within the enclosure should be large enough to accommodate a possible dozen assembly components. Adequate work space will allow the technician to clean the individual components, store the cleaned parts under glass beakers, and then assemble the entire unit. In addition, work space is also important outside the actual enclosure. We have provided the necessary external work area by mounting two enclosures on the extreme left and right of a table. This arrangement allows two technicians to work at one table and provides enough space on the table between enclosures to perform the necessary operations outside the enclosures.

Accessibility of the components being assembled in the enclosure is another important design factor. A great majority of the work done at the laboratory requires the use of a microscope in assembly operations. Commercially available enclosures require that the microscope be within the enclosure or partially accessible through a flexible coupling. This means that adjustments in focusing have to be made over the work; and in some cases, the operator's head is also directly above the work.

The flexible coupling of the eye pieces through the enclosure not only created an additional source of contamination but reduced the general visibility and restricted the placement of the microscope. This is the primary reason that we decided to design our own enclosure. We felt it necessary to remove the microscope and the operator's head from the interior of the cabinet and work through an almost horizontal glass surface directly above the work area.

Fabrication and Structural Material

Fabrication techniques and type of material used in the enclosure deserve careful consideration. In making an enclosure that demands freedom from foreign matter, the fabricator should follow principles that will facilitate the removal of this material. For example, welds should be carefully ground and polished to eliminate particle-trapping crevices. Coved corners are necessary for the removal of matter trapped in the enclosure.

A noncorroding material, such as stainless steel, is probably one of the best materials available for this type of enclosure. The absence of a coating caused by corrosion on the inside of the enclosure precludes one source of unwanted particles. In addition, lack of a surface finish eliminates the possibility of paint particles ending up in the assembly. Each day before use, the enclosures should be cleaned with solvent, vacuum hose, and nylon cloth or lens tissue by the technician who will use the enclosure.[3]

Utilities Required

This inclusion of certain utilities with outlets included in the enclosure will make the unit more effective and the operation less arduous. A vacuum outlet within the enclosure together with a small vacuum hose and small tools can serve to remove dust particles. A variable transformer is installed for heat control in assembly operations. We also require variable transformers used in conjunction with microscope lamps to be fixed mounted to eliminate their

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Fig. 2: *Three basic principles should guide the design and operation of a dust-free enclosure: (1) positive pressure provided by a gentle air flow, (2) comfortable working conditions, and (3) a carefully maintained dust-free atmosphere in the "white room." Arm ports on the Instrumentation Laboratory enclosures are located on the sides of the unit, so that the air is directed away from the technician. Enclosure is divided into two separate compartments, the forward section serving as the work area, while the rear section contains apparatus such as filter, blower and utilities.*

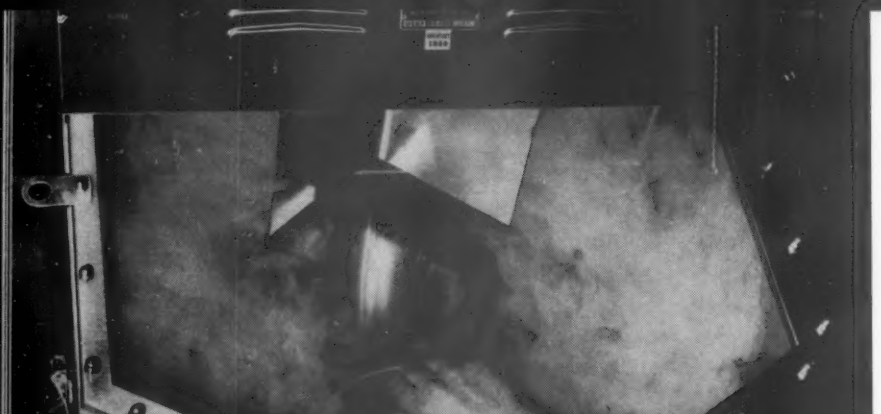

Fig. 3: *Smoke test illustrates the path of air around the inner periphery of the enclosure. Thus, the air flow in the cabinet will prevent particles from entering, but will not cause dust already in the enclosure from settling on the part.*

(Continued from preceding page)

110-volt line cords. Room is available for any future equipment that may be required.

Microscope Mounting

Mounting of a microscope outside the enclosure eliminates a source of particles entering the work area. We accomplish this objective by the use of a glass top on a relatively short enclosure and by setting the microscope on the glass. The assembly is then viewed through the glass. A special stand allows the microscope to be tilted toward or away from the operation and to be free to move over the entire glass surface.

In our Instrumentation Laboratory microscope (generally used 20x to 40x at 8 and 4 in. working distances), the microscope stand was modified so that, in its lower position, the microscope almost touches the glass surface. This modification has helped cut down on the over-all height of the microscope.

Air Flow

An environment of particle-free stagnant air is ideal for the enclosure, but access ports and operator's hands preclude this condition. A flow of air is required from these areas to avoid the introduction of particles through them.

Blower capacity and location of the air outlets from the enclosure are another important pair of factors in enclosure design. Although there is no set standard for blower capacity, we have found that an air flow of 20-40 cfm will provide adequate positive pressure in an enclosure occupying from 3 to 5 cu. ft. Access to the work area is best served by arm ports. One serious objection to a completely open front is the constant flow of air hitting the technician in the chest.[4] The Instrumentation Laboratory enclosure features a pair of arm ports that open on each side of the unit and direct the air away from the worker.

Observation of the air-flow pattern through the use of dry ice and water will indicate possible turbulence in this critical area. At present, we are modifying the enclosure with an air baffle to direct the flow of air around the inner periphery of the cabinet and out of the arm ports. This leaves the work area with almost still clean air.[5]

Utility Section and Filtering System

Division of the enclosure into two separate sections is very desirable. With the rear section containing the blower, filter, and other utilities separated entirely from the forward section, there is more space and cleanliness in the actual work area. The use of access panels facilitates changing filters and maintenance of other utilities. In addition, incorporation of removable plates on ends of enclosures allows two or more of the units to be combined, if coupling of utilities between enclosures is desired.

Choice of filter for incoming air can be a critical factor. Some paper filters will themselves shed particles which will be blown into the enclosure. Our laboratory is currently investigating a stainless-steel mesh filter to eliminate this difficulty; and thus far, tests indicate a high degree of effectiveness.[6]

Enclosure Adaptability to Various Component Sizes

The assembly area within the enclosure should be designed for adaptability to various sizes of components and assemblies. The enclosures used in our laboratory contain adjustable wells to allow this versatility. A mechanical jack elevates or lowers an aluminum disc that serves as the work surface. This disc also rotates and is an aid in the inspection of large areas by rotation under the microscope rather than movement of the microscope itself.

Illumination Arrangement

The rear lighting of the work within the enclosure may prove inadequate unless the fluorescent lamps are

...nted to allow the light to reach the front of the ...rk area. The actual work area is illuminated by ...e microscope light.

Requirements of White Room

The precision assembly done in a "white room," ...here air is supplied through an AEC type filter, ...s a distinct help in achieving the desired results ...within the enclosures. Extreme cleanliness is essential ...n a "white room," and all factors contributing to ...dust-free operations should be observed. The quali...ties that are essential in the operation of a "white ...oom" have become somewhat general knowledge in ...the field of precision instruments.[7] The human factor ...annot be avoided; therefore, the enclosure serves as ...the final barrier between foreign particles and the ...components being assembled. ▲▲

CRITICISM AND COMMENT

We sent Mr. Schiesser's article to Robert Avery of Cambridge Filter Co., for comment and criticism. Here are Mr. Avery's comments, together with Mr. Schiesser's replies, keyed to superior numbers in the text.

1. *Mr. Avery:* "It is usually assumed that a 10 micron particle is the smallest particle which can be seen by the naked eye. At 100X this would be a one micron particle and at 40X this would be a 1.58 micron particle. This would represent good precision."

Mr. Schiesser: "This is true. However, through the use of bounce-light, the size of visible particles comes down to almost one micron. Higher magnification would interfere with work, because of decreased depth of field and visible work surface."

2. *Mr. Avery:* "Do you mean construction or performance standards?"

Mr. Schiesser: "There is a lack of standards for both construction and performance."

3. *Mr. Avery:* "Where does dirt come from?"

Mr. Schiesser: "Mostly from incoming air. Some dirt comes from personnel. The least amount comes in on the parts being assembled. These parts are cleaned ultra-sonically before coming to the white room, but a few particles still remain and have to be removed at the enclosure."

4. *Mr. Avery:* "Would like to see proof of the statement that 'one serious objection to a completely open front is the constant flow of air hitting the technician in the chest.'"

Mr. Schiesser: "I agree that velocities are the same. However, this enclosure *directs* the air away from the technician's chest because of arm pit location."

5. *Mr. Avery:* "Dirt comes from either the air, the operations or the operator. If the air . . . the filter is at fault and it would probably be best to have still air. If from the operation . . . why the dust-free requirement?"

Mr. Schiesser: "We are working on filter improvement. All parts are cleaned in the enclosure before assembly. Turbulence in the work area has been found to deposit removed particles back on the parts. On the other hand, the part isolated from the outside air by a 'ring' of pressure remains particle-free after cleaning" (see photos, Figs. 1 through 4).

6. *Mr. Avery:* "With regard to the statement about paper filters shedding particles, and the alternative use of stainless-steel mesh filters, it may be possible, but it is most improbable, that the paper filters will shed particles, once the system has been 'broken in.' Stainless steel filter is a new one to me, unless it is the edge type used in liquid filtration. These are expensive."

Mr. Schiesser: "The stainless steel filters are expensive and the filter is a new type. The MIT lab buys the stainless steel mesh and fabricates its own filter. Operators have commented on fewer particles within the enclosure when the stainless steel filter is used."

7. *Mr. Avery:* "The photos (Figs. 1, 2 and 3) show workers handling parts with fingers and contaminating them with skin oil and perspiration, instead of using tools, or latex finger cots."

Mr. Schiesser: "Workers do not handle parts with fingers. They hold fingers away from parts and work with tools. As a result, skin oil, perspiration and dust from workers is not a real problem. Finger cots have not been used because they interfere with fine operations and can be pinched off during certain work."

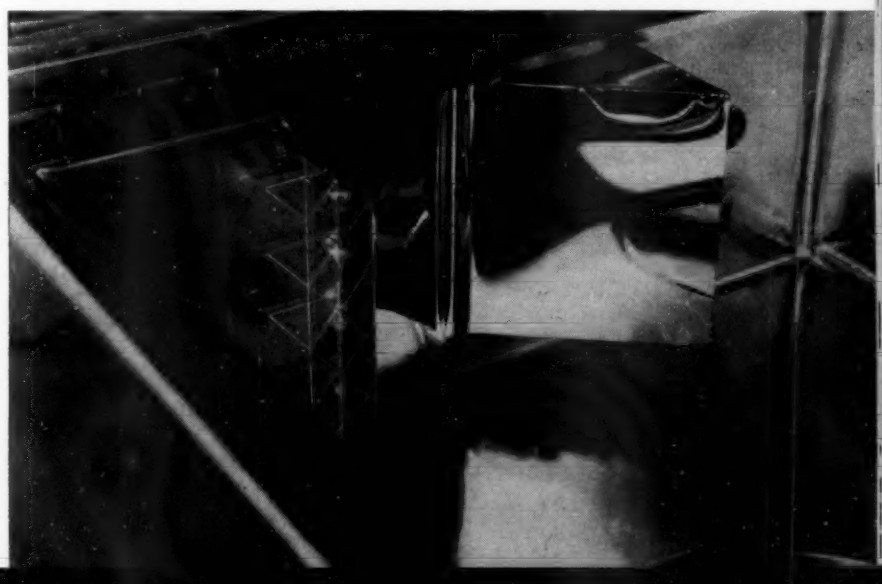

Fig. 4: *Baffle was incorporated to guide air around the inner periphery of the enclosure.*

What You Should Know About RESPIRATORS

PART IV

If plant ventilation system fails and workers face lethal concentrations of toxic gases . . . if dusts are hard to control, you may need respirators. Here's the fourth of a series on industrial dusts, gases and vapors . . . and the respirators to protect against them.

by **H. H. Fawcett**
Research Laboratory
General Electric Co.

Fig. 1: *Self-contained breathing apparatus. Photo courtesy General Electric Research Laboratory.*

THE NEED FOR ADEQUATE mechanical ventilating systems throughout industry is self-apparent. Need for occasional, or even full-time use of respiratory protective devices may not be quite as apparent, and the problem may be further complicated by the literally hundreds of types of such protective devices now on the market.

This article is designed to give you a quick review of where, when and why respirators should be used, and a basic knowledge of the various types of respirators, their applications and their limitations.

In the previous two parts of this series we have discussed classification of air contaminants (January issue, page 42 and March issue, page 52). In this issue we take up self-supplied types of respirators, and their applications.

Self-Contained Breathing Apparatus

Self-contained breathing apparatus supply complete respiratory protection in any concentration of toxic gases and under any oxygen deficient atmosphere. However, certain gases and vapors will cause systemic poisoning by skin absorption. Although a small group, these exceptions are highly important, including hydrogen cyanide, nitro and amino aromatic compounds, ethylene amine, phenols, and a few others. These gases and vapors require complete *skin* protection of an impervious type in addition to respiratory protection.

Early self-contained rebreathing apparatus, which was imported from Europe, had serious deficiencies. Loss of life was reported by users in this country; 19 accidents are reported involving 26 facilities between 1911 and 1940, due partly to equipment failure and partly to improper use. Where life-lines and standby rescue squads were employed, the apparatus was generally satisfactory in the hands of well-trained users.

The first self-contained breathing apparatus to be approved by the U. S. Bureau of Mines was the 2-hour rebreathing type.

The oxygen rebreathing type apparatus (Fig. 3) is relatively heavy (39 lbs. for the 2-hour type) and is bulky. Most self-contained (closed circuit) oxygen breathing apparatus in use today require mouth breathing with a nose clip, but a full facepiece has recently been approved. Careful training is required in use and in maintenance of this apparatus. A minimum of 20 hours initial training is recommended by the Bureau of Mines.

Demand-type air and demand-type oxygen breathing apparatus is available in half-hour, quarter-hour and 7½ minute ratings. Only the half-hour demand apparatus is Bureau of Mines approved; the Bureau has no approval schedule at present for any self-contained apparatus of less than a half-hour. Although schedule of work on which the Bureau's half-hour rating is exhausting, large men under extreme stress have exhausted a half-hour (40 cu. ft.) cylinder in significantly less than a half-hour. Differing only in whether it is

supplied with compressed oxygen or compressed air, the apparatus weighs nearly 30 pounds for the half-hour type, with the large cylinder (40 cu. ft.) on the back. It is relatively awkward to put on and it restricts action in confined spaces. With practice, it may be put on and into operation from a mounted backboard in less than 30 seconds but pre-use checks, as recommended by the manufacturers should still be made. The back position of the cylinder makes it difficult to crawl under equipment. Climbing in and out of small openings, such as manholes, requires care when wearing this type apparatus. Operation of a motor vehicle is awkward when wearing a cylinder on the back. (15-minute and 7½-minute overcomes this objection to some extent).

Purity of Charge Should Be Questioned

Purity of the air or oxygen with which the cylinder has been charged should always be questioned since other gases such as nitrogen, acetylene, carbon dioxide, and gas mixtures other than air have actually been found in "breathing air" cylinders. Errors in compressed air used for breathing may be rapidly fatal, and every newly-filled cylinder should be checked to insure it actually contains "breathing air", regardless of the source of supply.

If demand-type apparatus is worn in environments where pressure above one atmosphere is present (as in caissons or tunnels under higher than atmospheric pressure), service time is reduced as pressure increases. This is also true of underwater use of regular demand-type apparatus; a special adaptation is available for underwater swimming. Other peculiar effects have been reported when demand and closed circuit oxygen breathing apparatus was worn under pressure.

The use of *oxygen in atmospheres above two atmospheres absolute pressure* should be avoided since oxygen produces a toxic effect under such conditions. For periods up to 12 hours at normal atmosphere pressures, however, oxygen may be used without apparent ill effects by healthy persons—perhaps in questionable physical condition should *not* wear any emergency breathing equipment, but should remain away from contaminated air and underwater. Highly important in any underwater use of breathing apparatus is the necessity for continuous breathing during the ascent—at no time should one hold his breath.

When the supply of air or oxygen has been depleted, supply in the demand type apparatus cuts off abruptly, and the facepiece must be immediately removed or asphyxia can occur. One British half-hour breathing apparatus has available as optional equipment an automatic warning whistle (Pat. No. 644105) which will start to blow when the cylinder pressure falls to 300 lb./sq. in., to aid in warning the wearer to return to fresh air at once.

The seal around the facepiece must be absolutely gas-tight in a toxic atmosphere since in the demand-type apparatus the facepiece is under slight negative pressure momentarily during the beginning of the inspiration phase of the cycle. A recent revision by one manufacturer eliminates this negative pressure part of the cycle. Another novel feature of another demand mask (54 cu. ft. of air or oxygen divided between two 26 cu. ft. cylinders for balance) is a plug-in attachment carried with the mask for administering resuscitation to an overcome person on-the-spot while still in a toxic atmosphere.

Fire Hazards Must Be Recognized

In the above discussions, no mention has been made of the fire and explosion hazard of air which is richer than 21 per cent in oxygen, or of pure oxygen itself. Air should not be replaced with oxygen, either in a breathing apparatus, in a ventilation technique, or for any other purpose, without full consideration of the increased potential hazards from fire, as the oxygen concentration increases above the 21 per cent oxygen content of air. A flammable vapor-oxygen mixture requires only about one-thousandth the energy to ignite it as does a corresponding flammable vapor-air mixture.

The self-contained oxygen-generating breathing apparatus is approved by the Bureau of Mines, and is rated for 45 minutes. Some of the models produced for the military are not Bureau of Mines approved, however. The weight of 14 lbs., carried on the chest and stomach, gives it a decided advantage both in weight and convenience over the demand-type apparatus, although the chest position creates limitations in use under some conditions. The highly exothermic reaction which generates oxygen from the potassium superoxide (K_2O_4) evolves significant heat, which might serve as an auto-ignition source to carbon-disulfide, ethyl nitrite, and nickel carbonyl vapors under extreme conditions. This temperature of the canister surface may reach 250 F, and is equivalent to the hazard presented by unshielded incandescent lamps, hot plates and steam pipes in such an atmosphere.

Disposal Must Be Done According to Instructions

Disposal of the self-contained oxygen-generating canisters must be performed according to instructions. Oil, grease, gasoline, or other flammable or combustible liquids must be kept from the canister mouth, to prevent an explosion. Only clean water in large quantities should be used to destroy a canister. The canisters should be promptly disposed of, and not be left where they could be re-used, or where they could contact combustibles.

For reasons noted under discussion of demand-type breathing apparatus, the self-contained oxygen-generating breathing apparatus should not be worn under pressures greater than two atmospheres absolute.

Next month, the fifth and final installment will discuss small self-contained inhalation devices, maintenance, training and medical precautions to be used in connection with respirators of all types.

* * *

$25.00 For Your Problem . . . And It's Solution!

Solved a knotty make-up air, dust collection, comfort or process cooling or air pollution problem?

Send us your problem, and how you solved it. If we use it for publication, you'll receive a $25.00 check.

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New PRODUCTS

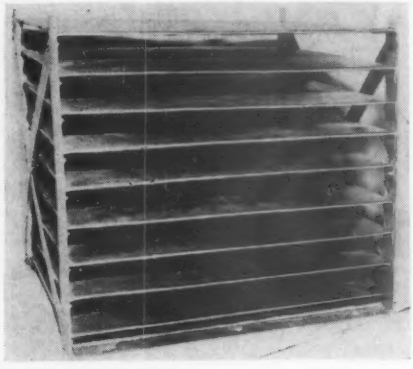

Plate Heater Bank Assembly for Air Conditioning Ducts

Purpose: Provides high capacity, low watt density heat exchange with fast heat up and with minimum restriction to air flow.

Features: Oven-type heater bank assembly consists of flat plate heaters mounted in tandem. Can be made in varying heights, lengths, and widths for installation in any size air duct.

Total of 3510 sq. in. of heat exchange surface per 10 kw capacity can be provided in 2535 cu. in. Heater banks can be connected for single or three phase, 208 volts or 440 volts.

Source: Electric Heater Specialty Co., Dept. AE, 21 E. 8th St., New York City 3.

Cast Aluminum Fan for Dust Collectors

Purpose: For use with Model 800, 1100, and 500 series Dustkops. Gives added advantages without additional cost.

Features: Spark proof fan is light in weight. Blades are moulded in position for greater strength and rigidity.

Source: Aget Mfg. Co., Dept. AE, 1384 Church St., Adrian, Mich.

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If you wish to contact manufacturers directly, street addresses are given. But please mention you saw it in AIR ENGINEERING.

High Temperature Indicating Control

Purpose: For ovens, plant processes, other industrial heating applications.

Features: Compact, remote bulb, type E36N is sensitive over range from 100 to 1000F. Three models feature three sensing bulb styles. Single scale with two-pointers indicates setting and controlling temperatures.

Source: United Electric Controls Co., Dept. AE, 85 School St., Watertown 72, Mass.

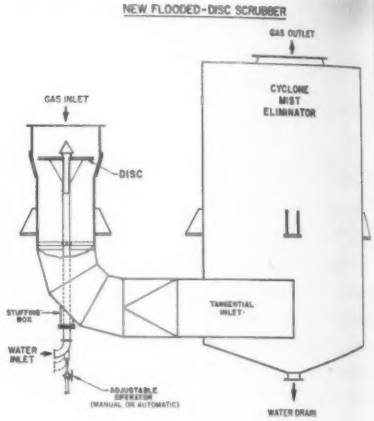
New Shaft Design for Heavy Duty Blowers

Purpose: Series 3200 lobe-type rotary positive blowers and gas pumps are for use on all heavy-duty industrial systems which have high volume air requirements.

Features: One-piece shafts slip-fitted through impellers and bolted to them at gear end. Design allows increase in diameter of shaft in critical area between impeller and gears without loss of impeller strength caused by an enlarged bore.

Units handle from 800 to 20,000 cfm at pressures from 2 to 10 psi continuous (12 psi intermittent). Machined sub-bases are standard equipment. Large sump with built-in oil filter eliminates need for oil cooler at ambients up to 125 F.

Source: Sutorbilt Corp., Dept. AE, Compton, Calif.



Flooded Disc Scrubber

Purpose: To remove sub-micron fumes from steel mills and chemical plants.

Features: Can adjust for maximum cleaning efficiency over a complete range of operating conditions. By recirculating dirty water without impairing efficiency, the flooded disc scrubber makes it possible to use smaller and more economical effluent treatment systems. Low pressure plant water cannot clog large area water passages.

Basic principle is a turbulent flow of a gas-liquid mixture that provides an intimate and violent contact between dust and liquid particles. Water injected into gas duct at center of disc is deflected to rim of disc where it mixes with incoming gas.

Water breaks up into extremely fine particles which collide with and adhere to dust fume. Fume-water mixture agglomerate particles which quickly become large enough for separation and collection in a cyclonic mist eliminator which follows the scrubber.

Source: Research-Cottrell, Inc., Dept. AE, Bound Brook, N. J.

PocketAIRE® Breathing Equipment

Purpose: Protection against breathing hazards encountered in fire fighting or industrial emergencies.

Features: Uses pure oxygen instead of compressed air. Has five-minute escape cylinder as extra precaution in addition to working cylinder. Leak-proof masks, full or half face.

Source: Rockwood Sprinkler Co., Dept. AE, Worcester, Mass.

Purifier Removes Hydrogen-Sulphide

Purpose: Wide industrial application but particularly applicable to paper mills, metal working plants which use cutting oil, industrial laboratories, rayon plants, petroleum refineries, and tanneries.

Features: Dorex canister-type purification equipment using a new specially impregnated type of activated carbon can remove H_2S, a gas previously impossible to control. New carbon offers a retentivity of 30 percent for H_2S, compared with a previous low of 3 percent.

Type H-No. 42 plastic canister specifically recommended for this kind of application.

Source: Connor Engineering Corp., Dept. AE, Danbury, Conn.

(Please turn to following page)

EQUIPMENT ENGINEERED TO PROVIDE DUST CONTROLLED WORK AREAS

Sterilshield by Baker

"STERILSHIELD" PROTECTION AGAINST MICROSCOPIC DUST PARTICLES

PREFABRICATED DUST CONTROLLED ROOMS

- Workspaces
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- Particle Counters
- Prefabricated Clean Rooms
- Dry Boxes
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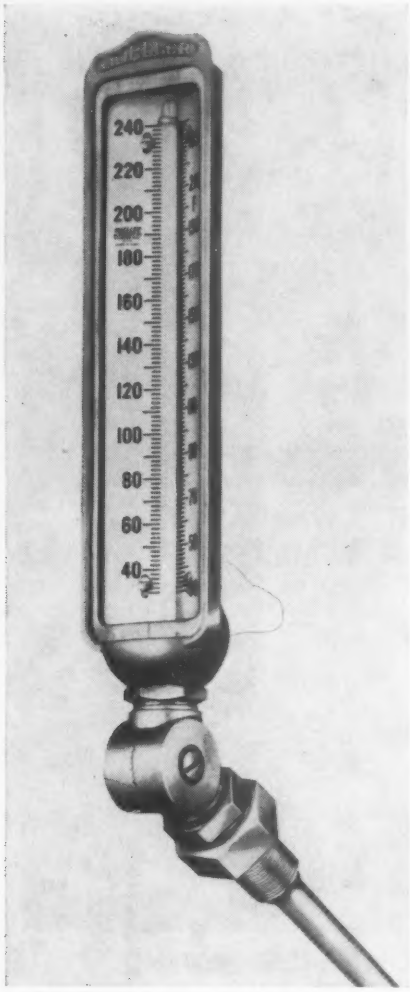
(Continued from preceding page)



Adjustable Angle Industrial Thermometer

Purpose: Eliminate selection problems for varying pipe line and air duct requirements.

Features: Instruments can be angle-adjusted right on the job to meet piping layout changes. Stem of thermometer tilts or rotates to any angle for reading without parallax error. Brass universal joint with stainless steel lock screw permits adjusting instrument before, during, or after installation.

Source: Moeller Instrument Co., Dept. AE, Richmond Hill 18, N. Y.

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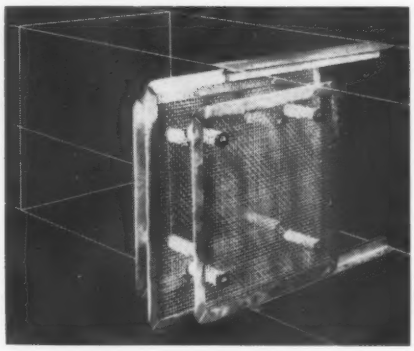


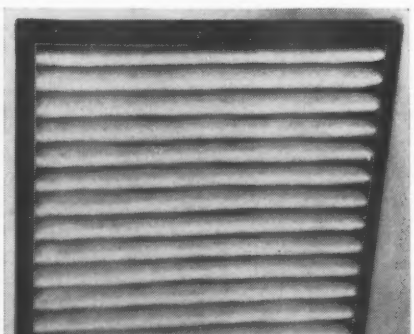
Electronic Dust Buster

Purpose: Shatters dust into particles so small they remain suspended in moving air. For installation in return air duct.

Features: Bank of three high voltage, statically charged Statronic screens shatter dust particles to a size well below 0.1 micron, so minute they become a permanent part of the atmosphere with little opportunity to settle.

As Statronic screens explode the dirt and dust, the air moving through the energy field becomes negatively ionized. Generator provides screens with static charge sufficient for a maximum of 10,000 cfm.

Source: CRS Industries, Inc., Dept. AE, 1405 Locust St., Philadelphia 3.



Extended Surface Air Filter

Purpose: Give a higher air-cleaning efficiency and greater dust holding capacity.

Features: Pure-Air extended surface filter consists of 2 in. high pleats set on 1½ in. centers. Each pleat is rigidly supported by a strip of cardboard set on edge. Under influence of air stream, each pleat becomes a parabolic shaped pocket. Total effective filtering area is said to be four times that of a fiber glass throw-away filter.

Source: Arco Mfg. Corp., Dept. AE, 542 W. 55th St., New York City 19.

Auditorium Unit Ventilators

Purpose: For use with hot water or steam heating systems to heat and ventilate large area rooms.

Features: Unique acoustical chamber permits extremely quiet operation. Units available in 16 sizes ranging from 1250 to 15,000 cfm at 0 to 1¼ in. external static pressure. May be installed in horizontal, vertical, or inverted position.

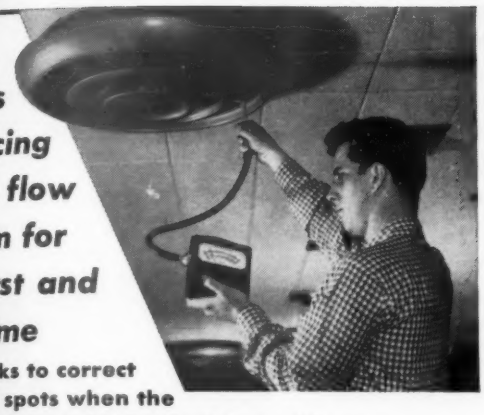
Source: Schemenauer Mfg. Co., Dept. AE, Holland, Ohio.

Portable, Cabinet Type Dust Collector

Purpose: Dust-Master model D-5 removes dust and chips from plant air.

Features: Double filter action insures clean air return. No moving parts are exposed. Cast aluminum fan is spark-proof. Non-overloading type suction blower draws dust and chip laden air into

(Please turn to page 52)



This man is balancing an air flow system for the first and last time

No call backs to correct hot or cold spots when the system is set up right the first time with an

Alnor VELOMETER®

Instant reading of air flow, in feet per minute, at outlets and draw of air at returns gives an accurate check on engineered systems.

The Velometer will also give direct readings of static pressure in ducts, plenum chambers, or pipes. Registers pressure loss across heater and filters, friction loss at ells and deflectors. Many government and municipal jobs require Velometer checking before acceptance.

The Velometer, set No. 3G recommended for commercial heating and air conditioning, is priced at only $194.00 including a sturdy reinforced carrying case.

Alnor INSTRUMENTS

ILLINOIS TESTING LABORATORIES, INC.
Room 574, 420 N. LaSalle St., Chicago 10, Ill.

SPLIT-EYELET CONNECTORS

For faster, easier connection of spray nozzles, branch lines and equipment to piping and tubing carrying liquids, gases or air up to 250 psi. Write for Bulletin 93.

FOR BETTER PERFORMANCE

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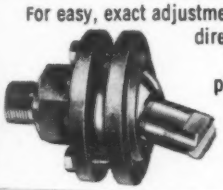
For easy, exact adjustment of spray direction. Made in size for ¼" to 2½" pipe in brass, steel and stainless steel. Write for Bulletin 97.



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FOR COMPLETE SPRAY NOZZLE INFORMATION WRITE FOR CATALOG 24

LINE STRAINERS

Special non-collapsing screen design for pressures up to 125 psi, for all pipe lines from ¼" to 6" size. Also high pressure strainers for up to 5,000 psi service. Write for Bulletin 94.

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3202 RANDOLPH STREET • BELLWOOD, ILL.

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Available in Stainless Steel
or Plastic . . .
with radius corners . . .
and complete filter systems . . .

Tubes being assembled at Chatham Electronics under #25 Dust Control Hoods

#25 Dust Control Hoods in use at Bell Telephone Laboratory

Specialists in the manufacture of Vacuum bake-out Dry Boxes and Dust Control equipment.

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Micromat®
SYSTEM OF AIR FILTRATION

NOW...

*Panel installation, McDonnell Aircraft

tailor air filters to job requirements ... economically

A *new concept* in air purification, MICROMAT offers not one but NINE separate and distinct filter media, each with certain capabilities. The MICROMAT System, with a medium to meet virtually any set of specifications for efficiency and air flow, provides the means of tailoring air filtration to your exact requirements.

Efficiency Range—5% to 85%
MICROMAT Replaceable Media are made from various types of non-woven synthetic fibers. Their natural filtering properties eliminate any need for viscous coating, yet MICROMAT media efficiencies range from 5% to 85% (using Discoloration Test procedures.)

Cut Maintenance Costs
MICROMAT filters normally afford appreciable savings in handling, changing, and storing when compared to permanent, washable type filters. Versatile in use, MICROMAT media are readily adaptable to panel (frame), blanket or roll machine installation.

Outperforms Conventional Filters
Present users have found that, at any given air velocity, the right MICROMAT medium will outperform conventional filters and deliver cleaner air at lower overall cost.

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Write for FREE Brochure-Catalog

Valuable information on air pollution and purification, plus complete technical data on MICROMAT media and installation. For copy, write on your company letterhead to

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CORPORATION
Dept. R-13 P. O. Box 2092, Charlotte, N. C.
In Canada, write
Bay Distributors, Ltd., 102 Main St. S., Weston, Toronto 15, Ont.

New PRODUCTS

(Continued from page 50)
cabinet through hose connected to hood over dust-producing machinery.

Fine particles are trapped in washable filters. Extremely fine particles are caught by cloth after-cleaner. Front door provides access to dust pan and filters.

Source: Cincinnati Fan and Ventilator Co., Dept. AE, 3548 Montgomery Road, Cincinnati 7, Ohio.

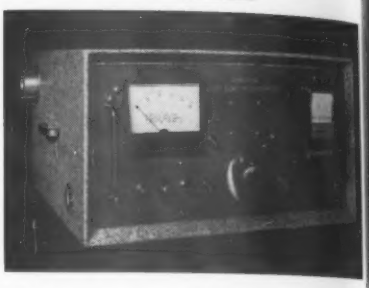
Bypass Weathermaster

Purpose: Cut up to 30% from cost of room units for high velocity, multi-story building air conditioning systems.

Features: Bypass Weathermaster contains factory installed and balanced control powered by the conditioned air itself. Control proportions air flow through cooling-heating coil while water flow remains constant.

Discharge grille sections are locked in place to prevent tampering. Redesigned cooling coil arrangement permits cleaning from front of unit. Available in six models.

Source: Carrier Corp., Dept. AE, Syracuse 1, N. Y.



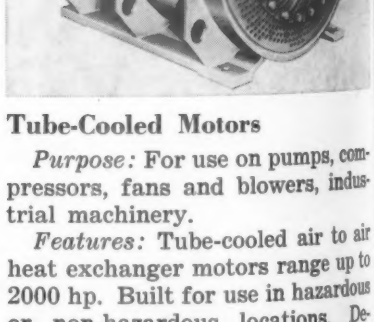
Light Scatter Photometer

Purpose: For continuous monitoring of atmospheres.

Features: Dual beam light scatter photometer is so sensitive it will detect changes in dust content of air after a person has walked through a room. Monitron operates by chopping a single light source into two separate beams and comparing many times a second, through the same photocell, the intensity of light reflected from particles scattered in air with the intensity of the monitoring beam.

Price: $1,250 f.o.b. Cincinnati.

Source: The Monitron Co., Dept. 1-AE, 1815 Wilaray Terrace, Cincinnati 30, Ohio.



Tube-Cooled Motors

Purpose: For use on pumps, compressors, fans and blowers, industrial machinery.

Features: Tube-cooled air to air heat exchanger motors range up to 2000 hp. Built for use in hazardous or non-hazardous locations. Designed to provide protection against excessive moisture, oil vapor, coolant and airborne dust, sand, dirt, and metallic particles.

Source: Louis Allis Co., Dept. AE, 427 E. Stewart St., Milwaukee.

Beryllium Dust

(Continued from page 36)

the need for tool transfer.

3) *Each process step should be examined critically to determine whether by rearrangement or substitution it can be made less dusty.* For instance, wet classifying is inherently less dusty than dry classifying.

4) *The manual transfer of process materials must be expected to be dusty and, consequently, should receive careful attention.* Where transfer containers are used, suitable exhaust must be provided for filling and emptying the containers. In transit they must be sealed and externally clean. Continued dusting from recently emptied containers is often troublesome; containers must not be taken outside the exhaust hood before residual dusting has abated or the container is thoroughly cleaned.

In some circumstances, it is economically feasible to substitute automatic conveyors for manual transfer operations with the consequent elimination of the dust problem. They are relatively easy to ventilate and require no attendance other than maintenance. Pneumatic conveyors are particularly well suited to handling a material such as finely divided beryllia. However, complications do arise when conveyors are dismantled for maintenance, and consideration must be given to protection for personnel. Portable ventilation is one means of providing protection.

Bearing these general rules in mind, each step of the process must be visualized to the smallest detail of operation to be sure that suitable control exists throughout. In the case of a new facility, specific steps often change in detail or even in concept during the design stage and, not infrequently, after the facility has been activated. Close liaison with engineering and production personnel is required to assure that the control provided will suit the operating techniques finally adopted.

Next month, Part II will discuss local exhaust ventilation problems, and cover such specific operations as manual, batch automatic, automatic unattended and material transfer. ▲▲

Questions & Answers

(Continued from page 25)

power driven model to about 31 lbs. for the battery powered model. Cost is around $400 to $500.

(C) *Recording carbon monoxide instruments.*

The recording carbon monoxide determining instruments are relatively expensive. They may either utilize the Hopcalite catalyze principle or the infra-red ray absorbing principle. The infra-red radiation utilizes a beam of infra-red radiation which travels through two parallel cells, one a comparison cell, and one a sampling cell.

If carbon monoxide is present in the air passing through the sampling cell, the gas absorbs the infra-red radiation and the temperature and pressure in the cell increases. This produces an expansion of the detector gas which causes the membrane of a condenser microphone to move. The movement when converted and electrically amplified produces an output signal. This is transmitted to a pen on a recorded chart.

The infra-red recorders are reliable, are easy to calibrate, and incorporate a self calibrating and checking mechanism. With long detecting tubes they can determine concentration down as low as a few parts per a million. They are fairly durable and require very little maintenance.

Carbon monoxide determining instruments utilizing the above principles of operation are available commercially with circuits to actuate alarms and to switch on and off fans. ▲▲

Pollution Control

(Continued from page 29)

Results

The installed collectors collect 100 percent of all dust 14 microns and larger.

All complaints have ceased and the City of Memphis Health Department, through their Engineer Director Everett C. Handorf, has approved the efficiency of this installation.

It is estimated that this installation will repay the capital cost in *two years* from the value of materials recovered.

Intangible savings are:

1. Improved formulation.
2. Greater production efficiency with resulting production increases using present man power.
3. Improved working conditions for employees.
4. Better public relations due to elimination of dust in neighborhood.

Total cost of the air pollution control equipment was $62,000, with $45,000 for equipment and $17,000 for installation. ▲▲

Prior Death

(Continued from page 24)

case was not the cause of the death of Pumpelly, but the cause of the alleged injury to the plaintiff; yet we are of the view that the certificate was prima facie evidence that at the time therein stated the plant or premises of the defendant, contrary to the testimony of the witnesses of the defendant, had fumes and gases arising from sulphur dioxide, and it was also evidence that such fumes were poisonous and could be the cause of death. . . . It was offered in rebuttal, and we think it was competent evidence tending to rebut the testimony of the defendant on a very vital issue." ▲▲

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RATES—Classified advertising is run in 6-point type (this size) under suitable headings. Minimum rate $5.00 for forty words or less. Extra words .15 each. Box addresses, with usual services, count as five words. Payment required with order. No agency commission, no checking copies. Closing date first of month preceding month of issue. No proofs will be submitted prior to running, but proof will be forwarded for record. No display advertising under classified headings. AIR ENGINEERING, 450 W. Fort Street, Detroit 26, Mich.

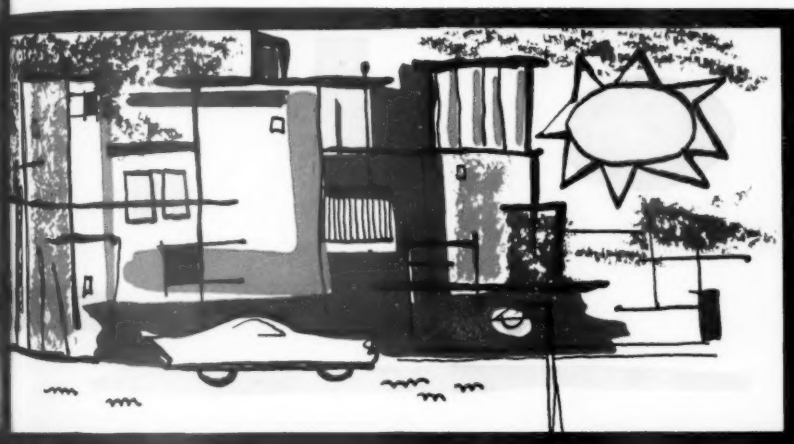
AIR ENGINEERING

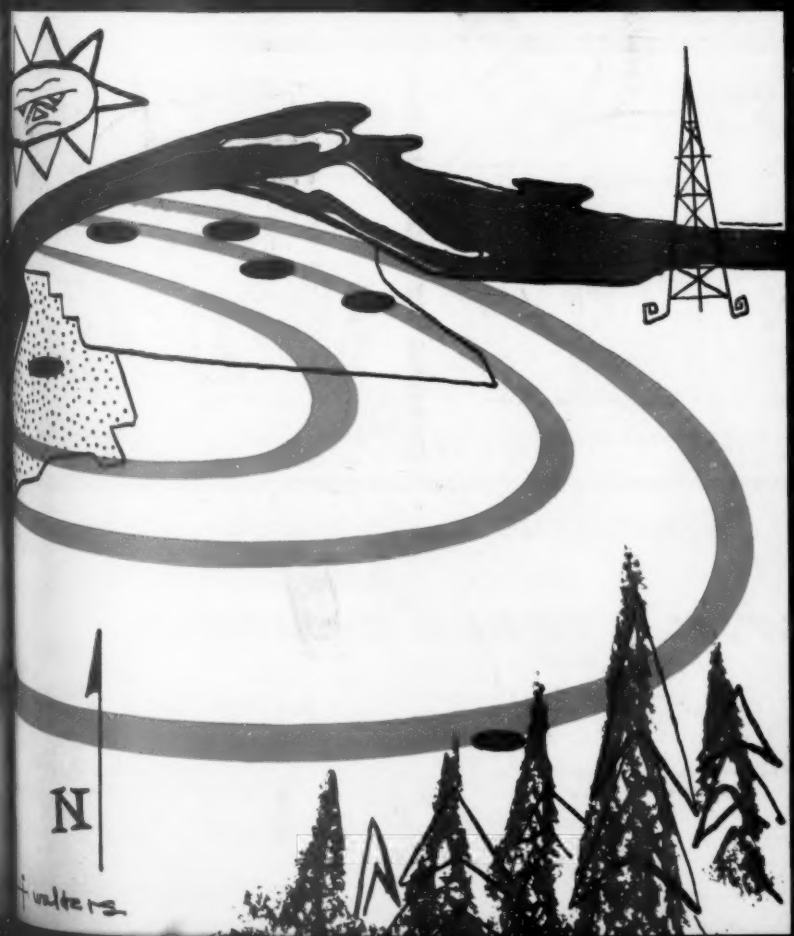
AUGUST, 1960

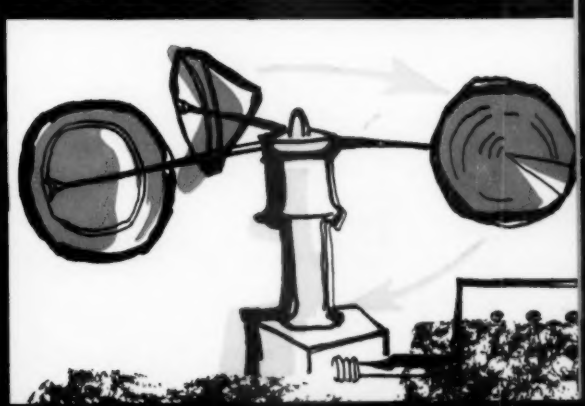
AIR POLLUTION CONTROL • AIR MOVING • AIR CONDITIONING

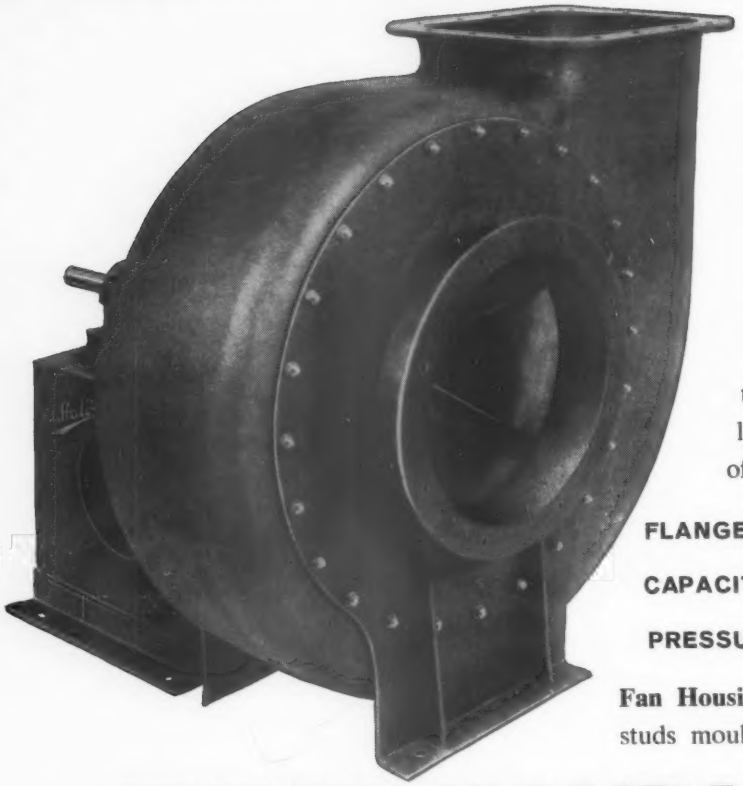
THE UNIVERSITY OF MICHIGAN
AUG 1 1960
ENGINEERING LIBRARY

- *How To Control Make-Up Air Heating Units*
- *Six Ways To Ventilate Tanks, Tubs and Kettles*
- *Caterpillar Cuts Cooling Costs With Humidity Control*
- *Simplified Guide To Fan Laws*
- *Effective Ways To Control Dusts From Beryllium Processes*









A BUFFALO RESIN-BONDED FIBER GLASS FAN MAY BE YOUR ECONOMICAL ANSWER

Excellent chemical resistance to a wide range of acids, salts, gases, organic materials and other corrosives — strength and resilience — ability to stand temperatures up to 300°F. with special resins — and light weight are some of the desirable characteristics of the 'Buffalo' Type FG Fan.

FLANGED INLET AND OUTLET—for gas-tight connections.

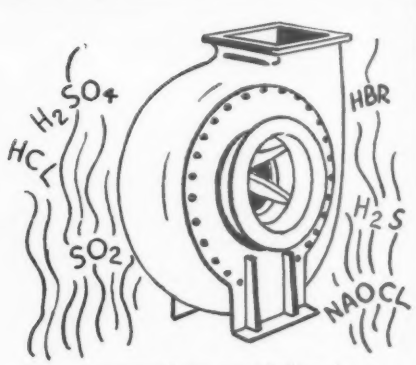
CAPACITIES — up to 34,000 cfm.

PRESSURES — up to 10″ static.

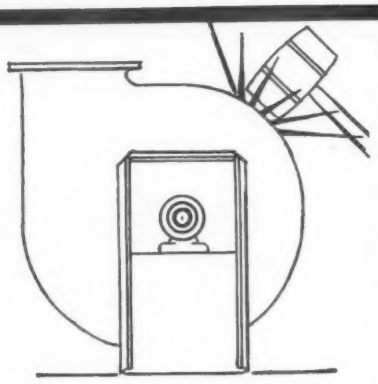
Fan Housing — resin-bonded fiber glass with stainless steel studs moulded-in for mounting to the bearing stand flange. Efficient scroll shape.

Rotor — husky steel wheel completely encased in resin-bonded fiber glass. Factory-balanced, statically and dynamically, for vibrationless performance.

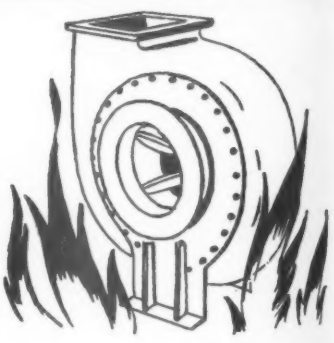
FUME-HANDLING PROBLEM?



corrosion-resistant



impact-resistant



won't support combustion

WRITE FOR BULLETIN FI-511 for all details and chemical resistance table.

"Buffalo"

BUFFALO FORGE COMPANY

Buffalo, New York

Buffalo air handling equipment to move, heat, cool, dehumidify and clean air and other gases.

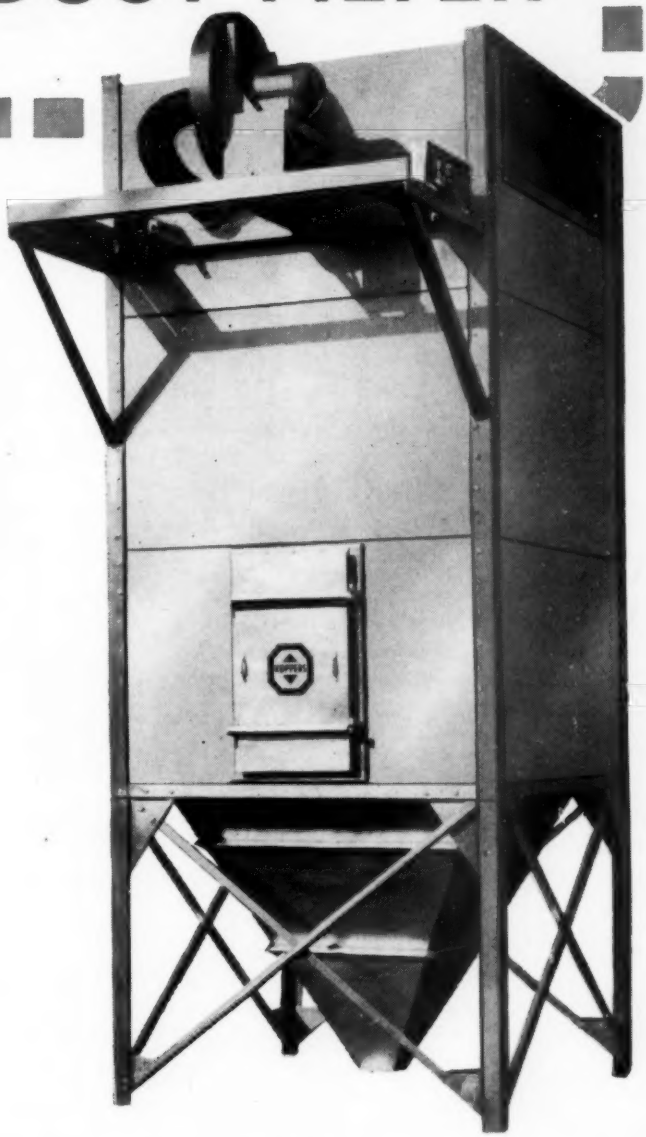
Buffalo Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

Buffalo Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier machinery to process sugar cane, coffee and tea. Special processing machinery for chemicals.

Reverse-air jet filtering comes of age with the

NEW KOPPERS MODEL K AEROTURN® DUST FILTER



NEW PERFORMANCE

Highest filtering efficiency and increased capacity are benefits you get in the all-new Model K Aeroturn. Fifteen years of diversified application experience have combined to produce a dust filter offering the utmost in performance and reliability.

NEW ECONOMY

Revolutionary new self-adjusting blow rings and proven pressure controlled filter cleaning reduce wear — increase filter tube life — cut operating expense. Rugged, simplified construction virtually eliminates maintenance costs and downtime.

NEW FEATURES

Koppers Model K Aeroturn has been completely redesigned for demanding industrial service—the only new reverse-air jet filter on the market. Such features as new blow rings, new carriage drive system and simplified, standardized design help you recover more product, cost less to operate and serve you more dependably.

NOW, MAIL THIS COUPON for complete information!

KOPPERS

AEROTURN® DUST FILTERS

Engineered Products Sold with Service

KOPPERS COMPANY, INC., Dust Filter Dept.,
4108 Scott Street, Baltimore 3, Md.

Gentlemen: Please send me a free copy of your new Aeroturn brochure complete with descriptions, drawings and photographs.

Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....

This stainless steel stack failed after only 6 months in corrosion service!

Over 2 years old . . . yet this Duracor stack shows absolutely no signs of attack inside or outside!

DURACOR VENTILATING SYSTEMS PROVIDE LASTING CORROSION RESISTANCE AT LOW COST!

Performance-proven Duracor Ventilating Systems and components provide outstanding resistance to attack from all types of corrosive fumes. These high-strength systems are corrosion-proof throughout . . . are practically immune to weathering . . . require only minimum support! Best of all, Duracor construction can save you up to 30% on your initial investment . . . and it's maintenance-free! Ceilcote engineers will design a complete Duracor system to meet your special requirements . . . or modify your present system to permit gradual conversion to Duracor. Fabricated to meet customer specifications . . . or assembled from stocked component parts . . . Duracor Ventilating Systems can be easily installed by regular plant maintenance crews or by experienced Ceilcote installation personnel. Write today for the new Ceilcote catalog.

DURACOR CEILCOTE

ANOTHER PRODUCT OF

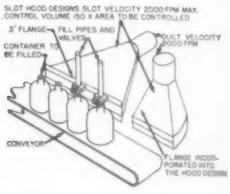
THE CEILCOTE COMPANY, INCORPORATED

4988 Ridge Road • Cleveland 9, Ohio

Watch For These Articles Next Month!

TECHNIQUES FOR BERYLLIUM DUST CONTROL

Valuable data for all air engineers whose plants use or will use beryllium in any way. Part III takes up drum filling, duct design and collector selection.

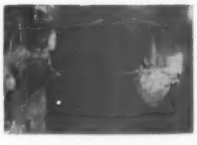

SLOT HOOD DESIGNS SLOT VELOCITY 2000 FPM MAX.
CONTROL VOLUME (SO × AREA TO BE CONTROLLED
3" FLANGE
FILL PIPES AND VALVES
DUCT VELOCITY 2000 FPM
CONTAINER TO BE FILLED
CONVEYOR
FLANGE INCORPORATED INTO THE HOOD DESIGN

SEVEN WAYS TO VENTILATE LIQUID CHEMICALS

Liquid chemical filling operations may expose operator to toxic or irritating concentrations of gases, vapors, or mists. Here's how to ventilate liquid filling operations.

HEATING AND COOLING COBO HALL

One of the world's biggest (over 37 acres) and newest (open in Oct.) convention halls has over 5000 tons of cooling, tough air distribution problems. Article tells how air problems were solved.



HOW TO STOP EMISSIONS FROM ELECTRIC FURNACES

Practical ways to stop air pollution from electric steel melting furnaces. Article takes up use of baghouses, roof ventilators, precipitators, gives system design data and costs.

Use Communications Center, page 37, for requesting more information about articles, advertised products, literature, and for comments about any of the editorial material in this issue of AIR ENGINEERING.

If you wish to contact manufacturers directly, street addresses are given. But please mention you saw it in AIR ENGINEERING.